

# **Network Centric Warfare Case Study**

U.S. V Corps and Third Infantry Division during Operation Iraqi Freedom Combat Operations

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# **NETWORK CENTRIC WARFARE CASE STUDY**

**U.S. V CORPS AND 3<sup>RD</sup> INFANTRY DIVISION (MECHANIZED)  
DURING OPERATION IRAQI FREEDOM COMBAT  
OPERATIONS (MAR-APR 2003)**

*Volume I: Operations*

By

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U.S. V Corps and 3<sup>RD</sup> Infantry Division (Mechanized)  
During Operation Iraqi Freedom Combat Operations (Mar-Apr 2003)

Volume I: Operations

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U.S. ARMY WAR COLLEGE  
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# Contents

List of Illustrations	<i>vii</i>
Foreword	<i>ix</i>
Preface	<i>xi</i>
Acknowledgements	<i>xiii</i>
Executive Summary	1
Operations	
1 Introduction	7
2 Study Methodology	11
3 Network Centric Warfare	13
4 Going to War	19
5 Findings and Observations	25
6 DOTMLPF	55
7 Recommendations	59
8 Conclusions	63
Notes	67
References	71
Appendix A: Peer Reviewers	
Appendix B: Personal Interviews	
Appendix C: Glossary	
Appendix D: Technical Systems	
Appendix E: Senior Officer Interview Questionnaire	
Appendix F: Officer Interview Questionnaire	
Appendix G: Survey Questions	
Appendix H: Survey Results	



# List of Illustrations

- Figure 1 Original Tenets of Network Centric Warfare 14
- Figure 2 NCW Tenets Expanded 15
- Figure 3 Network Centric Operations Conceptual Framework 15
- Figure 4 V Corps Road to War Timeline 21
- Figure 5 Combat Effectiveness 27
- Figure 6 Battle Command on the Move 29
- Figure 7 Leadership 30
- Figure 8 Speed and Confidence of Decisions 31
- Figure 9 Effects of Air Operations 33
- Figure 10 Enhanced Execution and Effects 34
- Figure 11 Increased Coordination from Situational Awareness 35
- Figure 12 Battlespace Management 36
- Figure 13 Battlespace Visualization 38
- Figure 14 Voice Communications 39
- Figure 15 Risk Awareness and Mitigation 40
- Figure 16 Risk Tolerance and Acceptance 41
- Figure 17 Fratricide Mitigation 42
- Figure 18 Information “Richness” 44
- Figure 19 Time for Analysis 44
- Figure 20 Plan Modification 45
- Figure 21 Limited Fielding 46
- Figure 22 Training and Exercise 47
- Figure 23 Planning, Exercising, and Rehearsing 48

- Figure 24 Red Intelligence Picture 49
- Figure 25 Intelligence Picture 50
- Figure 26 Stovepipes 51
- Figure 27 Connectivity with Others 51
- Figure 28 New Systems Connectivity 52
- Figure 29 DOTMLPF 55
- Figure 30 Current NCW Value Chain 59
- Figure 31 Proposed New Value Chain 60

# Foreword

This report highlights the results of a study of Network Centric Operations (NCO) as executed by V Corps and the 3<sup>rd</sup> Infantry Division (Mechanized), (3 ID (M)), during the major offensive combat operations of Operation Iraqi Freedom (OIF) from March 2003 through April 2003. The U.S. V Corps was the senior U.S. Army tactical headquarters responsible for operations conducted primarily along and to the west of the Euphrates River, to include the seizure of Baghdad. At the onset of the campaign (crossing the Kuwait-Iraq border) 3 ID (M) was the only ground maneuver force available to V Corps and continued as the corps' main effort through the seizure of Baghdad.

As part of the preparations for combat, both V Corps and 3 ID (M) received new sensor systems, including the Hunter UAV (at corps) and the Long Range Advanced Scout Surveillance System in the division. They also received extended connectivity systems (primarily in the form of increased bandwidth for the Tactical Satellite Communications system and the newly fielded Blue Force Tracker with satellite-based text messaging capability) and new information systems (e.g., the Force XXI Battle Command Brigade and Below coupled with the Blue Force Tracker transceiver, and the Command and Control Personal Computer (C2PC)). Collectively, the use of these new systems allowed a comparative analysis of the theory of Network Centric Warfare to its practical application in major combat for the first time.

This report will be of interest to U.S. Army and joint force designers, those concerned with the networking of the force, students of leadership and those interested in the implications of network centric operations at the tactical, operational and strategic levels of warfare.

This research was conducted by the U.S. Army War College in cooperation with and for the Office of Force Transformation, Department of Defense.

Douglas B. Campbell  
Director, Center for Strategic Leadership



# Preface

During the past decade, U.S. Armed Forces have been in the process of transforming from an industrial age to an information age military. This transformation is still ongoing; however, Operations Enduring Freedom and Iraqi Freedom demonstrate the emerging power and potential of transformation, at least in part, through the power of information-networked forces.

In March 2004, the U.S. Army War College (USAWC) in cooperation with the Office of the Secretary of Defense (OSD) Office of Force Transformation (OFT) initiated a study focusing on the U.S. Army V Corps' and 3<sup>rd</sup> Infantry Division's (Mechanized) major combat operations during Operation Iraqi Freedom (OIF). This study, entitled "Network Centric Warfare Case Study: U.S. V Corps and 3<sup>rd</sup> Infantry Division (Mechanized) during Operation Iraqi Freedom Combat Operations (March-April 2003)" is one of several "case studies" commissioned by OFT to determine the military's ability to conduct operations in accordance with network centric warfare (NCW) concepts. The OFT describes NCW as an "information superiority-enabled concept of operations" that will enhance combat effectiveness by networking sensors, shooters, and decision-makers.

The study hypothesis postulates that "improved sensors, connectivity systems, and networked information technologies enhanced the combat effectiveness of U.S. V Corps and its subordinate units during OIF major offensive combat operations." The results largely validated the study hypothesis. This study argues that the introduction of extended reach communications and networked information technologies significantly enhanced the ability of U.S. Army commanders to make faster decisions, more easily exploit tactical opportunities, conduct coordinated maneuver while advancing further and faster than at any previous time and more fully integrate and synchronize joint fires; all of which resulted in the rapid defeat of Iraqi military forces and the fall of the Ba'athist Regime in Baghdad.

The study is arranged in three volumes.

Volume I, entitled "Operations" uses the metrics provided in the Network Centric Operations Conceptual Framework as the guide in the conduct of the analysis concerning the applicability of NCW tenets during the conduct of major offensive combat operations. The analytical findings and observations of this volume validated that, during OIF, new sensors, extended connectivity, and new information systems enhanced the combat effectiveness of the force. This volume documents the impact of networked information on the application of combat power, battlespace synchronization, decision-makers and staffs lethality and survivability; force agility and operational tempo.

Volume II, entitled "A View of C4 Architectures at the Dawn of NCW" analyzes the command, control, communications, and computers architecture to ascertain the potential strategic and operational implications of net-centric operations from a command and control perspective.

Volume III, entitled "Network Centric Warfare Insights" is divided into two sections. The first section presents potential overarching strategic and operational impacts of network centric operations, based on findings in the first two volumes. Section two presents a series of battle stories / vignettes illustrating the impacts of the various new technologies on actual combat actions and battles.

The U.S. Army War College served as the executive agent for this study. The research was conducted by the Center for Strategic Leadership's Information Warfare Group (IWG). The IWG study team used military personnel to manage the program and conduct the data analysis and contractors from MPRI (Military Professional Resources Incorporated) (an L-3 Communications owned company) to collect the data through personal interviews and documents, and write the report. USAWC also provided numerous other people and resources to assist in survey preparation and distribution, administrative support, and audio-visual support.

The uniqueness of this effort lies in its landpower focus. While previous case studies have quite adequately covered the “shooter-sensor” interface from a systems perspective, none have addressed the impact of NCW from the human perspective. This is the essence of land warfare, and why this study is so important.

# Acknowledgements

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E. B. Vandiver, Director, Center for Army Analysis

We wish to thank General W. Scott Wallace and the many other officers who made time available for our interviews. Without their participation this study would not have been possible. We thank the 539 officers who took the time and effort to participate and complete our survey. Without their participation, it would not have been possible to gather the level of empirical data and the rich body of comments that informed our findings.

Colonel (Retired) Fred Stein, MITRE Consultant, deserves thanks for his valuable help in producing the briefings and for his insights and assistance in understanding network centric thought. Dr. Kim Holloman from Effects Based Research provided valuable insights on understanding the Network Centric Operations Conceptual Framework and its utility, and he ensured that our survey was correctly mapped to that framework.

The U.S. Army Research Institute (ARI) provided guidance and assistance in the development of our survey and approved its use. The U.S. Army Human Resources Command, Theater Data Base provided the list of officers who served in both V Corps and the 3<sup>rd</sup> Infantry Division (Mechanized) during the selected timeframe of this study. Colonel Tom Kruegler of the Center for Strategic Leadership at the U.S. Army War College provided numerous valuable insights concerning the command and control systems used by V Corps during OIF.

Special thanks is due to Dr. Charles Kirkpatrick, U.S. V Corps Command Historian, and the personnel from the Center for Army Lessons Learned (CALL) for their assistance in gaining access to the many documents that were used in the conduct of this research. Colonel (Retired) Greg Fontenot was kind enough to provide us his insights and to allow us the use of maps and

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# Executive Summary

## INTRODUCTION

This is a study designed to investigate the applicability of Network Centric Warfare (NCW) tenets during the conduct of major offensive combat operations by U.S. V Corps and the 3<sup>rd</sup> Infantry Division (Mechanized) (3 ID (M)) in Operation Iraqi Freedom (OIF). Therefore, this study is focused at the tactical level of war. The tactical operations conducted by U.S. V Corps and its lead division, 3 ID (M), occurred during the period 19 March to 9 April 2003. The study consists of three parts. Volume I presents the results of the study, Volume II presents a series of battle stories that illustrate the impact of the various new technologies on actual combat operations, and Volume III analyzes the Command, Control, Communications, Computers and Intelligence (C4I) architecture to ascertain the potential strategic and operational implications of netcentric operations.

From the strategic, operational, and tactical levels of war, OIF was significantly different than Desert Storm (1991). OIF was an offensive operation focused on the removing the Saddam Hussein regime from power. The land forces required for completing the operation were not in theater at the start of hostilities and were significantly smaller than those employed during Desert Storm. The campaign did not follow separate phasing of operations as did Desert Storm; rather, OIF conducted simultaneous operations.

The operations were enabled by an enhanced information environment with a shared common operational picture and a highly synchronized joint team. Information has always been crucial to combat success. It enhances the power of leadership and magnifies the effects of maneuver, firepower, and protection. OIF was no different; however, during OIF new levels of information availability led to widespread situational awareness and understanding resulting in greater synchronization of the joint force and increased combat effectiveness. As a result, land forces fought continuous engagements with greater tactical dispersion than at any time in the past, fighting both doctrinal Iraqi forces and non-doctrinal, asymmetrical, forces.

## PURPOSE AND SCOPE

This study examines the validity of the central NCW hypothesis that “a robustly networked force improves information sharing; collaboration; quality of information; and shared situational awareness resulting in dramatically increased mission effectiveness.” This study documents the impact of networked information on the application of combat power, battlespace synchronization, decision-makers and staffs, lethality and survivability, force agility, and operational tempo.

## METHODOLOGY

The study was conducted in three phases: (1) Research, (2) Data Collection, and (3) Analysis. The literature research involved reviews of available literature on NCW. The document research involved collecting and reading numerous lessons learned, operations plans and orders, and a vast amount of briefing material that had been prepared prior to and immediately after the

operations. The Center for Army Lessons Learned (CALL), the V Corps Command Historian, and other sources were vital to the collection of the necessary documents.

The data collection effort was bifurcated. First, over fifty personal interviews were conducted (averaging two hours each) to collect the qualitative information and provide meaning to the data collected by other methods. The personal interviews also included limited quantitative data. The second method of collecting data was a web-based survey distributed to selected officers, those assigned or attached to either V Corps or 3ID (M) during the March-April 2003 timeframe. A total of 539 officers completed the survey, out of a possible of 1,875, and provided the quantitative data necessary for empirical use. Survey respondents also were able to provide comments that furthered the qualitative data collection effort.

The data analysis was a continuous process beginning with the research phase. Extensive analysis of the survey data began at the end of the third quarter of this study and continued through the fourth quarter.

## **STUDY HYPOTHESIS**

This case study modified the original NCW hypothesis to remove the immeasurable adjectives of “robust” and “dramatic.” Further, the hypothesis was modified to include enablers that formed the basis of a networked force—the linking of sensors, command and control, and shooters/actors/ effectors. The study hypothesis postulates that “improved sensors, connectivity systems, and networked information technologies enhanced the combat effectiveness of U.S. V Corps and its subordinate units during OIF major offensive combat operations.”

## **BOTTOM LINE**

This study validated that, during OIF, new sensors, extended connectivity, and new information systems enhanced the combat effectiveness of the force. The information sharing increased the situational awareness, which improved the knowledge of the battlespace and increased both the speed of maneuver and the responsiveness and precision of fires. The extended connectivity allowed the force to fight more widely dispersed and over further distances than at any time in the past. The availability and reliability of the information allowed for rapid re-task-organization and full integration of newly arrived units into combat operations. The level of networking, although still an immature network during OIF, and a shared common operational picture allowed disparate forces to be linked and synchronized in time and purpose.

V Corps and the 3 ID (M) broke the molds of the Battle Command Training Program (BCTP), the National Training Center (NTC), and current Army doctrine to fight in new ways. The division commander was involved in four widely dispersed simultaneous brigade-sized fights, each with a different enemy and under different conditions. He commanded while on the move and led from forward positions. The corps commander was involved with resourcing the current fight, conducting shaping operations for the future fight, resourcing the security of the rear area and lines of communications, and planning for the future integration of forces as they arrived in the theater. He also conducted the majority of his leadership responsibilities from forward locations in the

battlespace while on the move or at the short halt. The way these commanders fought their forces was enabled by the network and was characterized by a high degree of battlespace synchronization, faster decision-making, distributed and understood intent, increased lethality of fires, and speed of maneuver.

However, as in the past, when forces made contact with the enemy, commanders still needed to develop the situation to gain enemy information. The movement from the Kuwaiti border to Baghdad could be considered a movement to contact. Information collected by ground and airborne sensors did increase situational awareness of the terrain before engaging the enemy, but the enemy adapted and fought in non-doctrinal ways, making the collection effort difficult at best.

## CAVEATS

There are at least three caveats that should be considered regarding the findings presented as part of this study. First, this study focuses on maneuver across open terrain. The findings may not be applicable to other types of operations, such as stability and support, and may not be valid in more complex terrain or in an urban environment. Second, when compared to U.S. and coalition forces, the Iraqi military and paramilitary forces were largely inept and ineffective. Third, the Iraqi military posed no air or sea threat, had only a limited ability to conduct localized global positioning satellite jamming, and never attempted to disrupt the U.S. networks. A more capable future force might yield dramatically different results.

## IMPLICATIONS FOR THE FUTURE

The aim of NCW is to provide all leaders with near real-time information that will allow them to understand the tactical situation and act within the commander's intent. This increased capability poses operational challenges. While subordinates have access to the broader tactical situation, commanders at increasing levels have access to layers of greater tactical detail. Higher-level commanders must not yield to the temptation to direct minor actions at subordinate levels, or their intervention could reduce the benefits of advanced information systems and the situational understanding they support. Therefore, it is necessary to develop strong leaders at all levels and to ensure that trust and cohesion are instilled throughout the force through tough, realistic training, exercising, and rehearsing.

## FINDINGS AND OBSERVATIONS

The findings and observations of this study are listed below. The 17 findings are presented with supporting rationale and data in the main body of the study. The observations (18-24) are based on the assessment team's insights and may be worthy of further research.

1. New information systems, sensors, and extended connectivity enhanced the combat effectiveness of U.S. V Corps and the 3 ID (M).
2. Increased connectivity and the flow of information at brigade-level and above provided an "untethered" ability to command regardless of location: "Battle Command on the Move."

3. Information systems are not a substitute for leadership; they help good leaders make better decisions “quicker.”
4. The new information environment enhanced the execution and effects of joint precision fires and maneuver.
5. Increased information and situational awareness allowed more positive management of the battlespace.
6. Interaction and/or correlation of information sources are required to gain situational understanding: “Battlefield Visualization.”
7. Voice communications were the primary means of gaining situational understanding and ensuring unity of command and effort at all levels.
8. Increased situational awareness had a significant positive impact on risk taking.
9. Increased situational awareness reduced fratricide.
10. Information systems and the “richness” they provided changed the way upper echelon staffs functioned.
11. Even a limited fielding of information/connectivity systems provided value added, but only when the limited systems were leveraged.
12. Training, exercises, and rehearsals with information systems are vital for commanders, staffs, operators, and organizations.
13. Organizing the command post is key to exploiting information.
14. The intelligence picture of the enemy was poorer than was expected.
15. The networks, as they exist, are stovepiped by function.
16. There is a connectivity gap below brigade-level; therefore, information is not reaching the lowest levels.
17. Bandwidth must be treated as a high demand, low density “class of supply” requiring command attention.
18. Knowledge, training, experience, and functional perspective are essential elements of how information is used.
19. There is not sufficient information to adequately define and/or qualify “robust” in terms of what constitutes a robustly networked force.
20. Situational awareness does not reduce the need for coordination to optimize synchronization.

21. Clearly defined responsibility and authority are still imperatives for decision-making and accountability in the combat environment.
22. NCW neither reduces nor replaces the need for survivable land combat systems and well-led forces.
23. Networking does not replace the need for planning, exercises, or rehearsals.
24. Information systems increase the need for reliable stable power sources and greater connectivity (bandwidth).



# Operations

*True genius resides in the capacity for evaluation of uncertain, hazardous, and conflicting information.*

— Winston Churchill

## 1. INTRODUCTION

The nature of war is volatile, uncertain, complex, and ambiguous. Because of these qualities, often manifested in the extreme, and warfare's continuous presence in human history, war has been the subject of countless studies and theories, poems and novels. Warfare and mankind have changed apace, evolving along with the invention and insertion of new technologies. The current change is characterized by the transition from industrial age technologies and thinking to that of the information age. This transition, concomitant with the shift from the Cold War construct (linear and contiguous) to that of the contemporary operating environment, is redefining the character of war. As with any change, some societies and organizations are adapting to these new technologies and instituting change more rapidly than others.

Some, however, have decided neither to invest in information age technologies nor to compete in this mode of warfare. For various reasons, they have elected instead to use alternative warfighting methods to seek the reduction or nullification of the effects of information age advances, such as sensors and precision munitions, in order to pursue their strategic goals.

### 1.1 Study Background

The Office of the Secretary of Defense (OSD), Office of Force Transformation (OFT) is the lead in moving the U.S. military from an Industrial Age organization to an Information Age organization. As such, the OFT determined that Network Centric Warfare (NCW) is the core concept that guides the transformation of the U.S. military. In theory, NCW is the embodiment of Information Age warfare. It is a concept of war based on Information Age principles and phenomena, and can be summarized by the tenets of NCW as stated in the Department of Defense (DoD) Report to Congress on Network Centric Warfare, dated 2001. These tenets state that a robustly networked force improves information sharing and collaboration, which enhances the quality of information and shared situational awareness. This enables further collaboration and self-synchronization and improves sustainability and speed of command, which ultimately results in dramatically increased mission effectiveness.

As part of this effort, the OFT and Office of the Assistant Secretary of Defense, Networks and Information Integration (OASD/NII) (formerly OASD/C3I) began the NCW Conceptual Framework Initiative in 2002. The objective of the initiative was to develop a set of metrics to assess the extent and impact of network centric technologies and practices. The Network Centric Operations Conceptual Framework (NCO CF) for Assessment, based on the tenets of NCW, identifies key

concepts and linkages to output measures in the NCW value chain in the context of the physical, information, cognitive, and social domains, identifies a vector of attributes for each concept, and defines important classes of attributes that are measurable with specific metrics.<sup>1</sup>

In 2003, the OFT began the NCO Conceptual Framework Program (2003-2004). The objectives of the program were to further develop and mature NCO theory and the NCO CF by applying it to case studies, experiments, and DoD, NATO, and coalition partner NCO-related efforts. Other objectives included documenting the impact of net-centricity, exploring the future of net-centricity, testing the hypothesis, and developing the knowledge of net-centricity.

In the summer of 2003, as part of the NCO CF Program, OFT, via a contract with Evidence Based Research, initiated six case studies using the NCO CF as the guide for collecting and analyzing data. The case studies are listed below:<sup>2</sup>

- Air-Ground Operations JTIDS (Joint Tactical Information Distribution System) Exercises—prepared by SAIC (Science Applications International Corporation).
- Naval Special Warfare Group One (NSWG1) operations during OEF (Operation Enduring Freedom) and OIF—prepared by Booz Allen Hamilton
- U.S./UK use of Blue Force Tracker (BFT) during combat operations in Operation Iraqi Freedom—prepared by PA Consulting
- Stryker Brigade Combat Team Certification Exercise operations—prepared by the Rand Corporation
- Multinational Operations: NATO Immediate Reaction Task Force (Land) (IRTF(L)) exercises and NATO Task Force Fox (TFF) operations in Macedonia—prepared by Reinforce
- U.S. Navy Commander Task Force Fifty (CTF-50) aboard the USS Carl Vinson—prepared by the University of Arizona

In March 2004, the U.S. Army War College (USAWC), at the request of OSD OFT, began a study focused on U.S. Army V Corps' and 3<sup>rd</sup> Infantry Division's (Mechanized) (3 ID (M)) major combat operations during Operation Iraqi Freedom (OIF). The USAWC served as the executive agent for this study with its Center for Strategic Leadership (CSL) providing the project manager, a data analyst, and senior military analysts from MPRI (Military Professional Resources Incorporated), Alexandria, Virginia who conducted the research, interviews, and case study preparation.

## 1.2 U.S. Army War College Case Study Mission Statement

Conduct relevant research through documents, personal interviews, and surveys investigating the applicability of NCW tenets in the conduct of combat operations by V Corps and 3 ID (M) during OIF. Produce required annotated briefings and a written case study focusing on information technologies and the impacts on command and control (C2) to further the study and development of NCW concepts.

### **1.3 Purpose**

To research the validity of the hypothesis that a “robustly networked force improves information sharing, collaboration, quality of information, and shared situational awareness resulting in significantly increased mission effectiveness.”<sup>23</sup>

### **1.4 Tasks**

1. Examine V Corps and 3 ID (M) operations to determine their conformity with current NCW tenets.
2. Document the impact of NCW practices and technologies on organizational and process innovations during OIF.
3. Identify divergence from the NCW framework.
4. Recommend changes to NCO CF.

### **1.5 Study Objectives**

1. Determine the impact of networked information systems on combat power.
2. Determine the impact on battlefield synchronization.
3. Determine the impact on commanders and staffs; did the systems provide for increased speed in their planning, coordination, and decisionmaking?
4. Determine impacts on lethality and survivability.
5. Determine impacts on force agility and versatility.
6. Determine the impacts on operational tempo.
7. Determine logistical impacts.
8. Determine impact on risk.

### **1.6 Study Hypothesis**

This case study advances the hypothesis that improved sensors, connectivity systems, and networked information technologies enhanced the combat effectiveness of U.S. V Corps and its subordinate units during OIF major offensive combat operations.



## **2. STUDY METHODOLOGY**

The USAWC approach to this case study involved extensive research and data collection as well as data analysis. The assessment team decided on a bifurcated approach in order to collect both qualitative data, in the form of rich vignettes from personal interviews, and quantitative data from a survey to provide the necessary depth of statistical support for the observations and findings. This study does not limit itself to any one information system but looked across the spectrum of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and organizational practices used by V Corps and 3 ID (M) across the Army's battlefield operating systems (BOS). The NCO CF provided the basis for all data collection.

### **2.1 Interviews**

Senior analysts at MPRI developed a plan for gathering documents and identified key personnel for interviews. They developed two interview questionnaires, one for senior officers (General Officers, Colonels, and certain General Staff officers) and one for all other officers. The questionnaires were based on the NCO CF and lessons learned from observing PA Consulting conduct interviews. Interviews were conducted to gather the rich vignettes from key personnel who qualified as true subject matter experts from two perspectives: first, an historical overview of the war, and second, observations they had concerning the impacts of the information environment in their respective area of the BOS. The interviews also included a limited number of questions designed to gather quantitative data for analysis. (See Appendix B for the list of personnel who were interviewed, and Appendices E and F for the interview questionnaires.)

### **2.2 Survey**

A survey instrument was designed to gather the empirical data required for in-depth analysis, providing the statistical basis of the study's findings. The survey was developed from the interview questionnaires and was modified to gather quantitative data, but it also allowed for limited qualitative responses. The U.S. Army Human Resources Command theater database managers provided the names and e-mail addresses of 1,875 officers who met the case study population parameters. The Army Research Institute conducted reviews and made valuable inputs to the survey instrument and gave final approval for the implementation of the survey. The survey was "launched" on 30 August 2004 and closed on 12 October 2004, with 534 officers completing the survey. (See Appendix G for the survey questions and Appendix H for the survey results.)

### **2.3 Research and Document Collection**

MPRI analysts conducted the collection of pertinent references and documents relevant to the study. The Center for Army Lessons Learned (CALL) at Fort Leavenworth, Kansas, and the U.S. V Corps Command Historian, Dr. Charles Kirkpatrick, in Heidelberg, Germany, assisted in this effort. Numerous documents were collected, both unclassified and classified, that provided insights as to how the units and command posts were organized and how they planned and executed operations.

## 2.4 Peer Review Process

The peer review process involved a series of reviews by three independent peer reviewers. This was planned for and incorporated into the study from the outset. The peer reviewers used for this study were General William S. Wallace for his command and operational expertise (he held the rank of Lieutenant General and was the V Corps Commanding General during the focused timeframe of this study), Major General (Retired) Robert Scales for his historical expertise, and Mr. E. B. Vandiver from the Center for Army Analysis for his analytical expertise (the biographies of the peer reviewers are located in Appendix A).

### **3. NETWORK CENTRIC WARFARE**

In 2001, the DoD proposed that NCW and NCO should be the cornerstone of DoD's strategic plan for the transformation of the forces.<sup>4</sup> The OFT determined that NCW is the core concept that guides the transformation of the U.S. military and describes NCW as an "information superiority-enabled concept of operations" that will enhance combat effectiveness by networking sensors, shooters, and decision-makers.<sup>5</sup>

NCW for the purposes of this study is defined as "an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision-makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace."<sup>6</sup>

"NCW is about human and organizational behavior. NCW is based on adopting a new way of thinking—network-centric thinking—and applying it to military operations. NCW focuses on the combat power that can be generated from the effective linking or networking of the warfighting enterprise. It is characterized by the ability of geographically dispersed forces (consisting of entities) to create a high level of shared battlespace awareness that can be exploited via self-synchronization and other network-centric operations to achieve commanders' intent. NCW supports speed of command—the conversion of superior information position to action. NCW is transparent to mission, force size, and geography. Furthermore, NCW has the potential to contribute to the coalescence of the tactical, operational, and strategic levels of war. In brief, NCW is not narrowly about technology, but broadly about an emerging military response to the Information Age."<sup>7</sup>

#### **3.1 NCW Tenets and Hypothesis**

The tenets driving NCW concepts state that a robustly networked force improves information sharing; that information sharing and collaboration enhances the quality of information and shared situational awareness; that shared situational awareness enables collaboration and self-synchronization and enhances sustainability and speed of command; and that these in turn result in dramatically increased mission effectiveness.<sup>8</sup> The central hypothesis of NCW is that a force with these capabilities can increase combat power by better synchronizing effects in the battlespace, achieving greater speed of command, and increasing lethality, survivability, and responsiveness.

#### **3.2 Network Centric Operations Conceptual Framework**

As stated earlier (paragraph 1.1), the NCO CF was developed to assess the NCW tenets. This NCO CF for Assessment identified the "top-level" representation of NCO concepts and their relations and then identified the attributes and metrics for each concept.<sup>9</sup> It also formed the basis for conducting this case study and was key in developing questions, both open/qualitative and quantitative, used in both the interview process and in the distributed survey. The NCO CF provides a means to evaluate the NCO hypotheses.

Figure 1 depicts the NCW tenets as originally stated.<sup>10</sup> Figure 2 illustrates how the NCW tenets have been developed and expanded as Evidence Base Research developed the Conceptual Framework. Figure 3 depicts the NCO CF, to include the top level tenets and attributes.

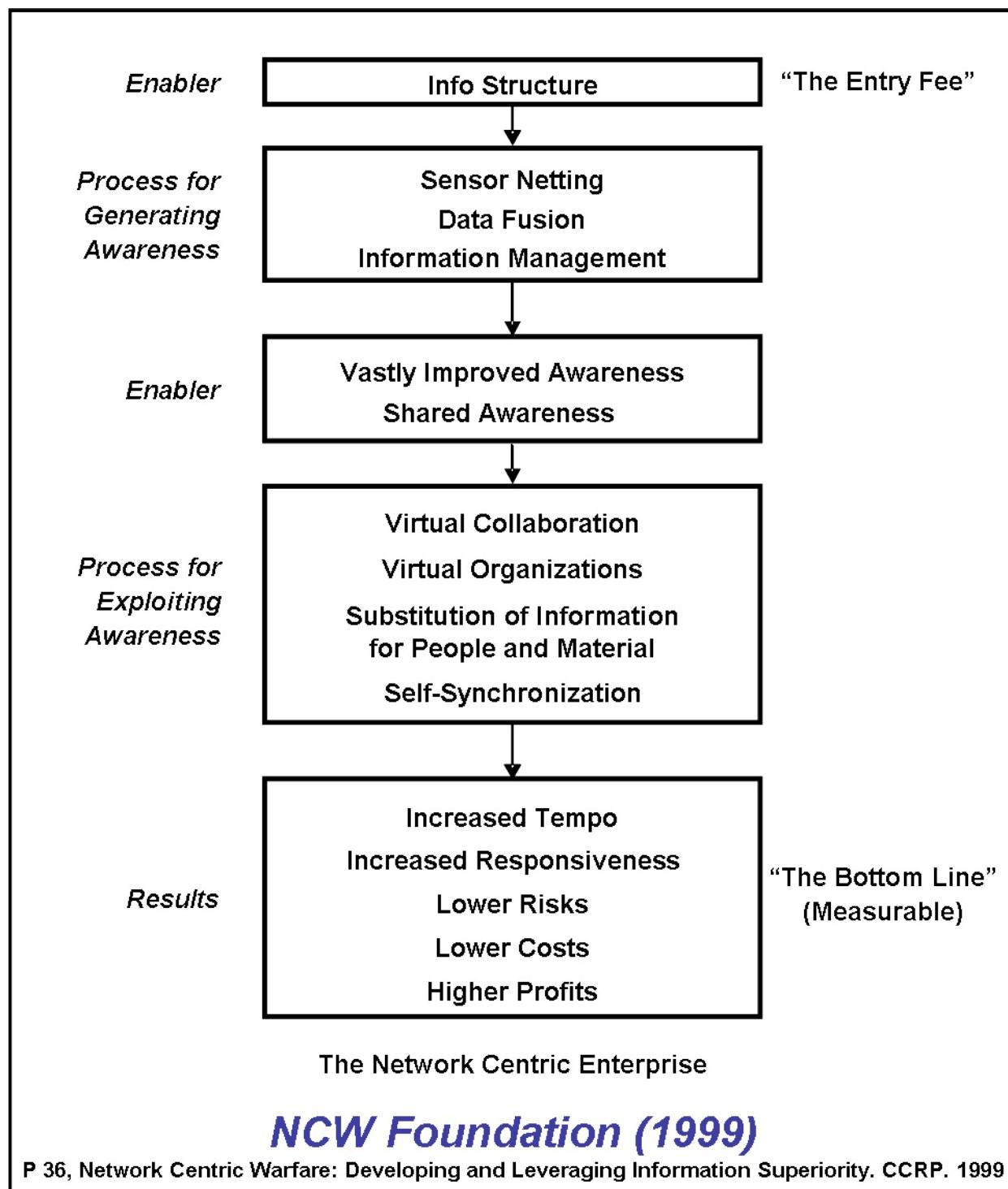


Figure 1. Original Tenets of Network Centric Warfare

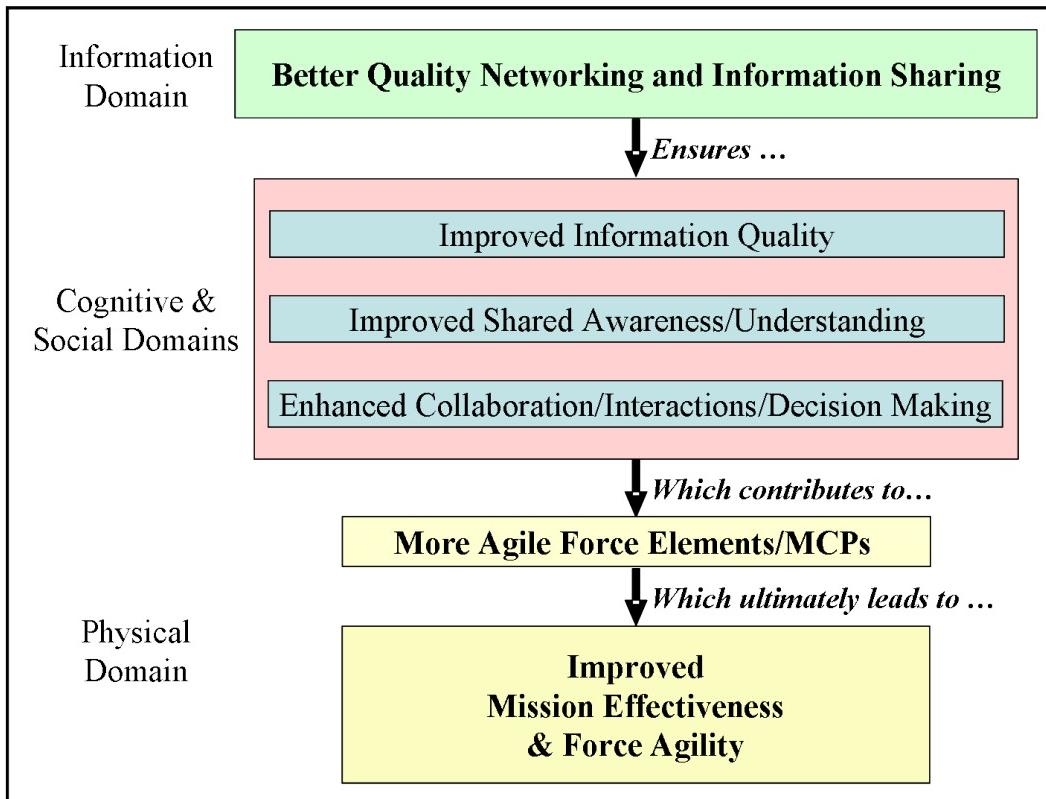


Figure 2. NCW Tenets Expanded

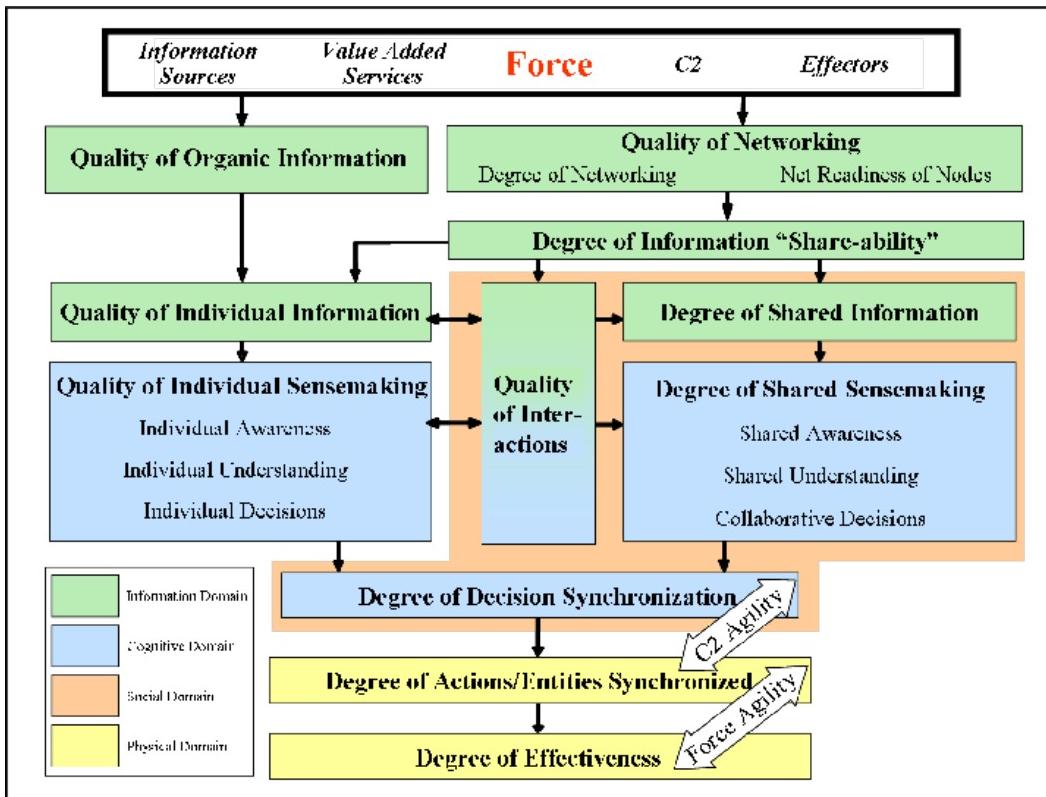


Figure 3. Network Centric Operations Conceptual Framework

### 3.3 Application of the NCO CF

It is not within the purview of this case study to provide a tutorial on the NCO CF; however, it is necessary to provide some presentation of the concepts and definitions presented in the NCO CF in order to better explain how the NCO CF framed this study. For greater information and understanding of the NCO CF refer to Network Centric Operations Conceptual Framework Version 1, dated November 2003, or Version 2, dated June 2004.

“Network Centric Operations is not about hardware and routers—it is about people, organizations, and processes. The Conceptual Framework highlights the fact that network centric operations cut across several domains: physical, information, cognitive and social. The central role of social interactions (including collaboration) is evident in the Conceptual Framework....The framework also distinguishes between individuals and ‘groups’ (teams, organizations, etc.). This is an especially important innovation as future operations are expected to be joint and involve interagency coordination and international partners.”<sup>11</sup>

As pointed out above, activities occur within four domains: the physical, information, cognitive, and social. The physical domain is where maneuver, fires, and force protection (among others) take place and occurs on land, at sea, in the air, and in space. The information domain is where information is created and is where information is manipulated, processed (value added), and shared. The cognitive domain comprises individual and group perceptions, awareness, understanding, decision-making, beliefs, and values. The social domain is where people interact, exchange information, awareness, and understandings, and make decisions.

The top bar of the NCO CF is titled “Force” and is not depicted as being within any of the domains, as it is integrated with all four. The “Force” here consists of four basic functions that are represented on the top bar (see figure 3).

1. Information Sources. These are the elements that collect or generate information relevant to operations. Information sources include sensors of all types, human intelligence (HUMINT), and organizations that collect relevant open source information, e.g., from magazines, newspapers, and web sites.
2. Value Added Sources. These sources fuse both data and information, add knowledge, interpret both data and information, respond to inquiries, and help to define needs for data and information.
3. Command and Control (C2). These are the elements that perform or support the command function or control function. These include commanders, staff personnel, and communications and information support, as well as decision support tools. It should be noted, for example, that a headquarters may perform more than one of the four roles shown in the Force.
4. Effectors. These are the elements that play a role by influencing the operating environment. Effectors include weapons information entities such as psychological operators and media spokespersons, electronic and cyber warfare entities, and those responsible for diplomatic, economic, and other effects.

The NCW tenets and its central hypothesis are described in paragraph 3.1 above. The steps that lie between a change in the network centric capabilities of the force and mission outcomes are considered the NCO “Value Chain.”<sup>12</sup> This value chain represents key network centric hypotheses and is represented in figure 2. The NCO CF elaborates and adds a set of attributes and measures to the value chain so that an attempt can be made to measure the hypotheses objectively and scientifically. The NCO CF top level concepts for measurement are reflected in figure 3, and each top level concept has associated attributes and metrics. These attributes and metrics allowed for the construction of interview instruments and survey questionnaires to test the hypotheses regarding the various top level concepts. The NCO CF lists the following thirteen top level concepts:

1. Quality of Organic Information – concerns information derived from the unit, community, or military organization. Information derived from or gathered by an entity that is not shared and is unavailable to the network remains local to the entity. For example, information collected by a scout remains local until forwarded out of the organization via a spot report.
2. Quality of Individual Information – is the first form of non-organic information that is encountered. It refers to all information available or presented and is the basis for awareness or understanding. Includes information distributed over a network and obtained through some interaction.
3. Quality of Networking – where networking is the interconnection of a system of people, communications, computers, data applications, security, and other support structures that provide information processing and services. The extent of interconnection among the force.
4. Degree of Information Share-ability – describes the network’s ability to accept, index, and transmit particular pieces of information, including data elements, data files, and streams of information quickly and accurately. The only concern here is the ease of making data or information available to the network and whether it can be found by those who need it.
5. Degree of Shared Information – refers to the extent information is derived from the network. While Organic Information and Individual Information, above, only look at quality, here the concern is with both the quality of the information/data and the extent it is shared.
6. Sensemaking – is where decisions are made and provides the link between the information domain and the physical domain where action takes place. This is largely a cognitive activity and takes place in the minds of individuals, not computers. Sensemaking is strongly influenced by individual experience and expertise, and social networks and interactions at the collaborative level.
7. Quality of Individual Sensemaking – involves the mental relating of both situation understanding with action. This is the realm that Carl Von Clausewitz called *Coup d’oeil*, that inward eye, that which refers to the quick recognition of a truth that the mind would ordinarily miss or would perceive only after long study and reflection.<sup>13</sup>
8. Degree of Shared Sensemaking – at the collective level is a collaborative process involving different functional perspectives and possible stakeholder interests. These perspectives

must be melded into a common problem framework. The collaborative aspects of shared sensemaking occur in the social domain.

9. Quality of Interactions – involves people and force entities actively sharing information and developing awareness, understanding, and/or making decisions or plans in a collaborative fashion while working toward a common purpose. This bridges the gap between Individual and Shared Sensemaking and occurs in the Information, Cognitive, and Social domains.
10. Degree of Decision/Synchronization – refers to the proportion of decisions and/or plans that are conflicted, de-conflicted, or synergistic. Decisions are choices among different courses of action or alternatives. In the context of this framework, they may take place across multiple levels of command: from the most senior level to tactical decisions ranging from weapons – target pairing to activation of contingencies.
11. Degree of Actions/Entities Synchronized – this occurs in the Physical domain where actions are conflicted, de-conflicted, or synergized and their impacts.
12. Degree of Effectiveness – deals with the impact of actions on the operating environment. The degree to which military/strategic/political/social/economic/diplomatic objectives were achieved.
13. Agility – plays is an especially important concept and is highlighted as C2 Agility and Force Agility. Agility in NCO CF context refers to the ability to be robust, flexible, responsive, innovative, resilient, and adaptive.

## 4. GOING TO WAR

*It is not the big armies that win battles; it is the good ones.*

— Marshall Maurice de Saxe

### 4.1 Historical Overview

At the conclusion of Desert Storm in 1991, which expelled the invading Iraqi forces from Kuwait, the UN Security Council (UNSC) passed numerous resolutions and imposed a number of strict sanctions on Iraq aimed at reducing the threat that the Saddam Hussein regime posed to its neighbors.

The UNSC passed four major resolutions concerning Iraq between 1990 and 2002. As a result of the Iraqi invasion of Kuwait in August 1990, the United Nations Security Council Resolution (UNSCR) 661 was established. This imposed comprehensive economic sanctions on Iraq and prevented imports into other states of all commodities originating in Iraq. UNSCR 687 (1991) required Iraq to respect the international boundary between Iraq and Kuwait, unconditionally accept destruction of all weapons of mass destruction (WMD) and monitoring and verification of same by United Nations Special Commission (UNSCOM) and the International Atomic Energy Authority (IAEA) inspection teams, and required Iraq not to acquire or develop nuclear weapons or nuclear weapon usable material or subsystems. UNSCR 986 (1995), also called the Oil-for-Food Program, allowed for a specified amount of Iraqi oil to be sold in exchange for humanitarian supplies—controlled by the UN—as a temporary means to stop the suffering of the Iraqi people, and it required a portion of the monies for war reparations. It also required Iraq to fulfill its requirements to the other resolutions.<sup>14</sup> Throughout the period the Iraqi Regime obstructed the inspection teams in their efforts, and in 1998, Saddam Hussein expelled the UN inspectors. In 1999 the UN teams were replaced by a UN Monitoring and Verification and Inspection Commission (UNMOVIC); however, Hussein continued his strategy of noncompliance. Finally in November 2002, the UN Security Council passed UNSCR 1441, which declared Iraq in material breach of the previous resolutions and set forth new procedures for the conduct of inspections and the threat of serious consequences for noncompliance. Following this final resolution, the UNMOVIC inspectors returned to Iraq and reported a systematic pattern of deceit and concealment by the Hussein regime. This last UN inspection team was withdrawn just prior to coalition actions to replace the Hussein regime.

Throughout the period from the conclusion of Desert Storm to the onset of OIF, the United States, United Kingdom and other coalition air forces enforced no fly zones over southern and northern Iraq. These operations were called Operation Southern Watch, which monitored and controlled Iraqi airspace south of the 33<sup>rd</sup> parallel, and Operation Northern Watch, which enforced the no-fly zone north of the 36<sup>th</sup> parallel in Iraq. Over the eleven years of these operations and UN sanctions, Iraq's military capabilities were severely degraded across all battle operating systems, most notably in aviation and air defense artillery systems.

Despite the numerous resolutions and their economic and military impacts and the constant patrolling of coalition air forces, Iraq continued to pose a serious threat in the region. Iraqi ground forces

numbered approximately 350,000 troops divided into 23 divisions. Six of these divisions were the elite Republican Guard Forces. The Iraqi air force and other aviation assets were not considered a serious threat due to the years of military supply shortages and the lack of any adequate combat training for their pilots. Iraq had no naval force of any consequence. However, Iraq was believed to have a credible WMD threat.

Throughout the intervening twelve years between Desert Storm and OIF, the U.S. military underwent significant changes and transformation.

1. In the years immediately following Desert Storm, the U.S. military successfully downsized its forces; Army active forces were reduced by almost 40%.
2. The military was involved in more deployments and operations than in any similar period of its history, with operations in such places as Somalia, Haiti, Rwanda, Bosnia, Kosovo, homeland security operations following the terrorist attacks of 11 September 2001, and Operation Enduring Freedom in Afghanistan.
3. During these years the aging C-141 was replaced with the more capable C-17, and additional shipping was procured to give greater strategic mobility to the force. New precision munitions were developed, such as the air-delivered GPS (global positioning system) guided Joint Direct Attack Munitions (JDAM), providing all weather capabilities against fixed targets, and the howitzer-delivered Sense and Destroy Armor Munitions (SADARM). The Army transformation also included the development of the Force XXI concepts, which brought new developments and enhancements to the art and science of battle command.

When compared to the U.S. forces, the Iraqi forces during the same time period lacked parts for vehicle repairs, failed to conduct individual and collective training, and were used for conducting counter-insurgency operations against Shi'a opposition groups. As noted above, the Iraqi forces were not prepared for the U.S.-led coalition and its full spectrum combat operations.

#### **4.2 Planning, Exercising, and Rehearsing**

*If I appear prepared, it is because before entering an undertaking I have meditated long and have foreseen what might occur. It is not genius which reveals to me suddenly and secretly what I should do in circumstances unexpected by bothers; it is thought and preparation.*

— Napoleon Bonaparte

Preparations for combat in Iraq for both V Corps and the 3<sup>rd</sup> Infantry Division (Mechanized) began well over a year in advance of 20 March 2003. Following the 11 September 2001 attacks, the intensity of training, planning, preparations, mobilizations, and deployments across the military, along with the improvements in military capabilities during the twelve years since Desert Storm, set the conditions for the successful OIF offensive.

*On Point* provides a detailed presentation of the planning and preparations that went into the successful OIF offensive and an excellent overall history of the entire operation. What is important to note for this study are the key exercises that V Corps used to prepare for combat (see figure 4). The numerous exercises were designed to test and rehearse deployment plans, RSO&I (reception, staging, onward movement, and integration) procedures, tactical maneuver plans, coordination procedures, standardize information system displays and requirements, joint operating procedures for fires, command posts and procedures, and selected subordinate organizations. Through these exercises, seminars, and rehearsals, V Corps was able to move from a USEUCOM<sup>15</sup> forward-based tactical Army headquarters largely familiar with in-theater forces to a deployed tactical Army headquarters in the USCENTCOM<sup>16</sup> area of responsibility using divisions with which it had not previously operated. The tasks for V Corps were monumental. Not only did they have to ensure that all subordinate commands—those coming from Germany as well as those coming from the continental United States (CONUS)—would be able to communicate with the corps headquarters, but that they would be prepared to operate off of a common version of software within the Army Battle Command Suite (ABCS) and other systems not included in the ABCS, e.g., the Command and Control Personal Computer (C2PC).

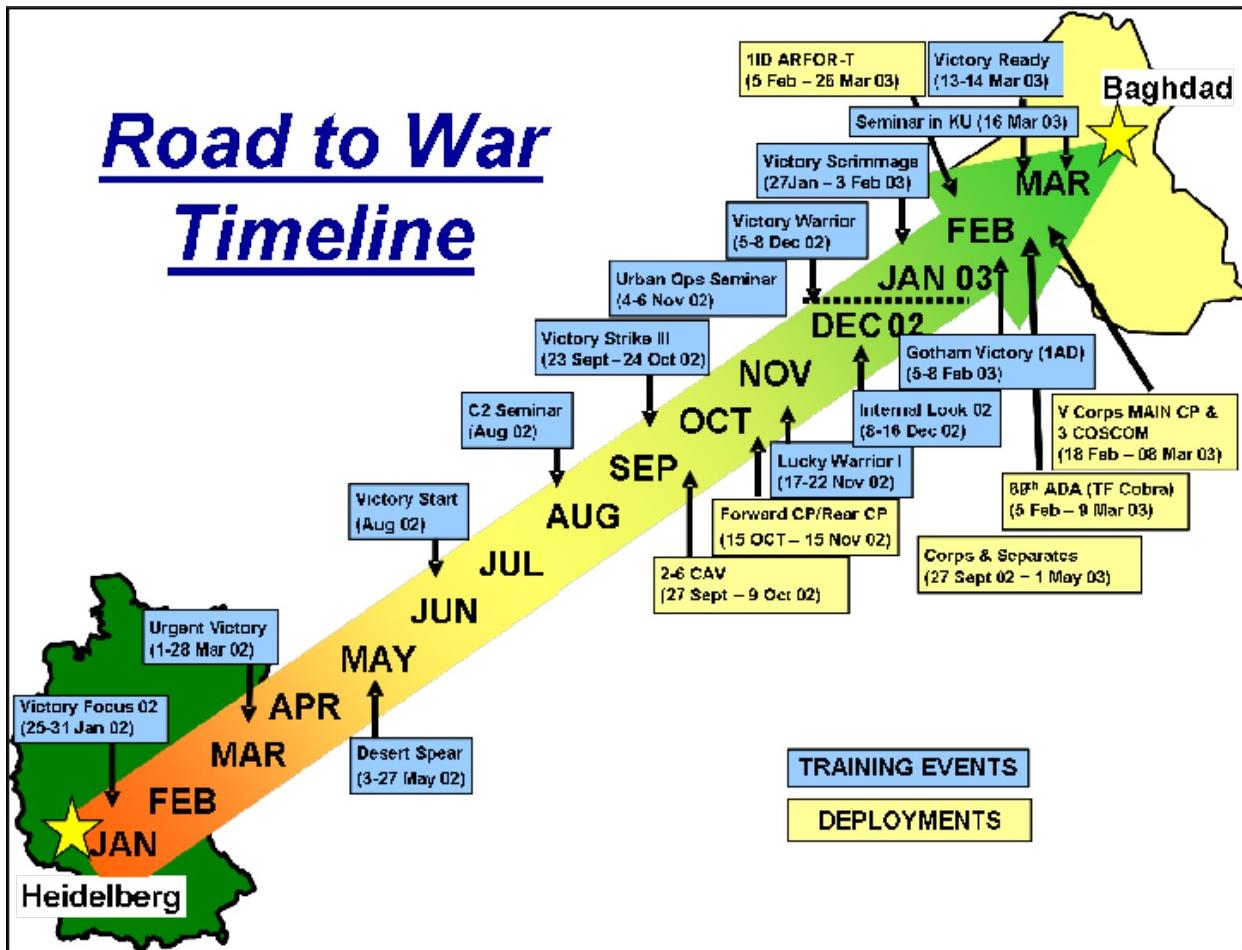


Figure 4. V Corps Road to War Timeline

Part of all of this training and exercising was to ensure that those working with information systems would be fully able to understand the systems and know how to leverage them to exploit

all available information. Even the corps commander ensured that he was proficient in using the systems that would provide him his situational awareness and understanding. However, some systems were not provided until units arrived in Kuwait. This limited the ability to fully train on new systems and hampered the development of TTPs (tactics, techniques, and procedures), which result from training, exercises, and rehearsals.

Overall, the quality of individual and collective training for all U.S. forces stood in sharp contrast to even the best trained of the Iraqi units; U.S. Forces were far superior in all respects. U.S. tactical units had prepared and rehearsed for over a year, and this training continued almost up to the initiation of hostilities.<sup>17</sup>

“The roots of the Division’s successful attack to Baghdad are found on the training fields of Fort Stewart, Fort Irwin, and Kuwait. The Division crossed the line of departure with a mature and trained group of staff officers, commanders, and soldiers.”<sup>18</sup>

#### 4.3 Execution

This study focuses on the combat actions of U.S. V Corps and the 3<sup>rd</sup> Infantry Division (Mechanized) from the period beginning 20 March 2003, crossing the berm from Kuwait into Iraq, through the seizure of Baghdad and the collapse of the Iraqi military on 9 April 2003.

The offensive operations against the Iraqi forces conducted by V Corps and its subordinate units differed in many ways from the offensive operations conducted twelve years earlier during Desert Storm.

1. There was no “air campaign,” attacking Iraqi forces in prepared defenses, preceding the ground attack. This was a joint campaign from the onset, with air and ground attacks beginning simultaneously.
2. The land forces required to complete the campaign were not in place from the start of the operation; rather, this was a “running start” with units continually arriving in Kuwait and moving through the RSO&I process. This level of complexity of receiving units and integrating them into combat operations had not been conducted since the defense of the Pusan perimeter at the start of the Korean War.
3. This was a campaign to eliminate the Iraqi Regime as opposed to liberating a country occupied by invading Iraqi forces.
4. There was increased cooperation and integration between conventional and special operations forces that, according to Lieutenant General Wallace, the V Corps commander, “worked like magic.”
5. New precision munitions increased the capabilities of the force. The air-delivered JDAM gave an all weather precision capability against non-moving targets and SADARM gave the artillery greater lethality against enemy armor, especially those in defensive positions.

6. New sensors like the Hunter UAV (unmanned aerial vehicle) and the LRAS3 (Long Range Advanced Scout Surveillance System) enabled tactical commanders to acquire targets at much greater range with significantly better accuracy. This improved the lethality of fires and allowed for greater freedom of maneuver.
7. Numerous new command and control systems/networked information systems (though the network was an immature network) provided a near-real-time common operational picture (COP) from the tactical maneuver company-level to the strategic-level. This COP and extended connectivity increased the situational awareness and understanding of the tactical commanders and enabled them to fight in ways that exceeded the limitations assumed in current doctrine.



## **5. FINDINGS AND OBSERVATIONS**

There are seventeen findings and seven observations in this study. The findings are supported through qualitative data developed from the interview process and/or survey comment input, quantitative data developed from survey responses or from the quantitative portion of the interview process, or by both qualitative and quantitative data. The observations are insights believed to be correct; they were gained primarily from the interview process but are not necessarily supported by a preponderance of data. We do not believe that many of the findings and observations will seem new to those involved with OIF, and some have already been mentioned in the official history (*On Point*) and in after action reports. Without doubt, U.S. forces fought in a substantially different way than they had during Desert Storm in 1991, and much of this difference was a result of improvements that provided commanders at all echelons an increased situational awareness and understanding and allowed them to employ their forces more effectively.

### **5.1 Caveats**

There are at least two caveats that should be considered regarding the findings presented as part of this study.

1. When compared to the U.S. and coalition forces, the Iraqi military forces were largely inept and ineffective. Their command and control was largely dysfunctional, and the level of individual and collective training was very poor.<sup>19</sup> Therefore, we believe there should be some caution in drawing conclusions when viewing these findings, as they may not necessarily apply against a better trained and led military force.
2. This study focuses on major combat operations in open terrain, a war of maneuver. We do not know if the findings are valid in more complex or urban terrain, or during other types of operations such as stability and support operations.

### **5.2 Definitions**

These findings refer to information systems and use the terms situational awareness, situational understanding, and COP frequently. Therefore, it is necessary that the definitions for these terms, as they are applied in this study, be explained.

1. Situational Awareness. In the context of this report, situational awareness is the ability to identify, process, and comprehend the critical elements of information about what is happening to the organization with regards to the mission within a particular area of operations. Simply put, it is knowing what is going on around you. For most military situations, time and space relationships (e.g., weapon ranges, rates of advance across different terrain) and the opportunities and risks relevant to the forces are also crucial elements.<sup>20</sup>
2. Situational Understanding. In the context of the cognitive domain, understanding is knowledge that has been synthesized and had judgment applied to it in a specific situation

to comprehend the situation's inner relationships. "Situational understanding involves understanding the current state of friendly and enemy forces. It is derived from applying judgment and experience to the COP through the filter of the commander's knowledge of the friendly forces, threat, and environment. Situational understanding includes physical factors (such as location of forces), human factors (such as fatigue and morale), and the relationships among friendly and enemy forces and the environment that potentially represent opportunities and threats for friendly forces. Commanders need to develop three views of each situation: a close-up view of the situation, a "feel" for the action gained through personal observation and experience; an overview of the situation and the overall development of the operation; and the situation from the enemy's perspective."<sup>21</sup>

3. Common Operational Picture (COP). An operational picture (a single display of relevant information within an area of interest) tailored to the user's requirements, based on common data and information shared by more than one command. "The COP is displayed at a scale and level of detail that meets the information needs of the command at a particular echelon. C2 systems fuse information from a variety of sources, while information systems facilitate its rapid distribution in usable displays that facilitate understanding."<sup>22</sup>
4. Information Systems. Information systems process data into information, carry and display information, or both: "...information is data that have been processed to provide further meaning. Processing includes filtering, fusing, formatting, organizing, collating, correlating, plotting, translating, categorizing, and arranging. Information is useful for immediate application. It can be used to avoid threats, acquire targets, or take other immediate actions. Information forms the basis of the COP."<sup>23</sup>

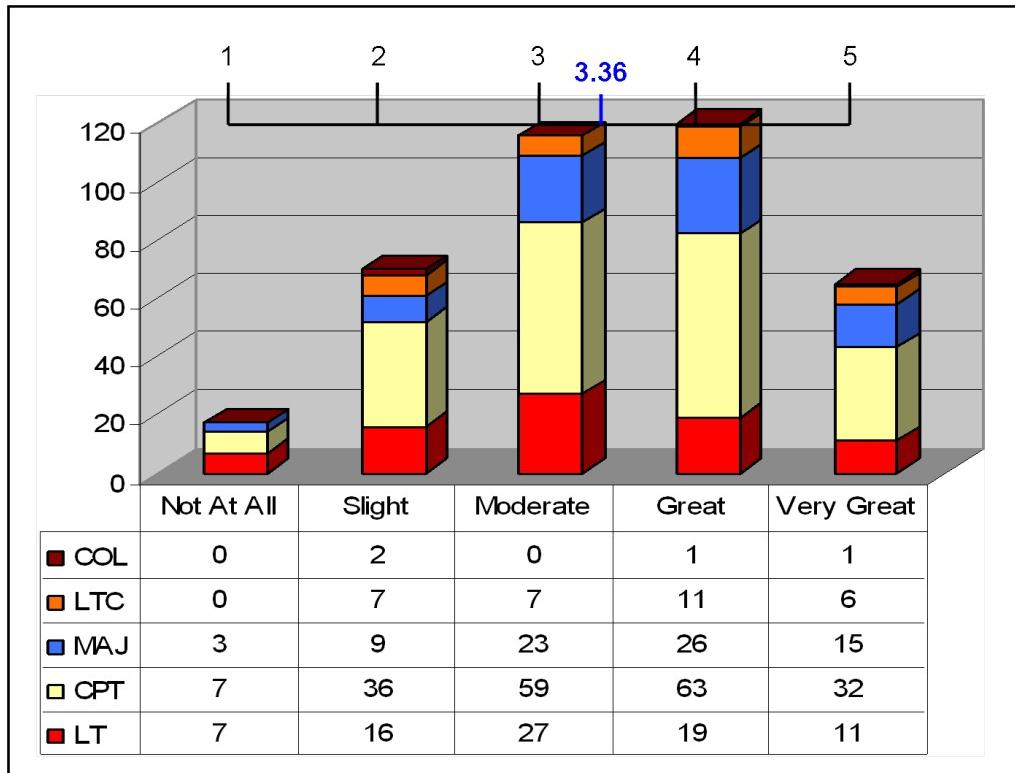
### 5.3 Findings

#### **Finding 1. New information systems, sensors, and extended connectivity enhanced the combat effectiveness of U.S. V Corps and the 3rd Infantry Division (Mechanized).**

One of the primary themes of NCW is that "...information superiority...generates increased combat power by networking sensors, decision makers, and shooters...."<sup>24</sup>

"Combat power is the ability to fight. It is the total means of destructive or disruptive force, or both, that a military unit or formation can apply against an adversary at a given time."<sup>25</sup> The term "combat effectiveness," as used in the context of this study, refers to the ability to combine the elements of combat power—maneuver, firepower, leadership, protection, and information<sup>26</sup>—to defeat an enemy and accomplish assigned missions.

The survey asked respondents to compare their OIF experiences with their previous experiences and determine the extent that new systems improved combat operations and enhanced combat effectiveness. Based on their responses and on comments during the interview process, officers with new systems in their organizations for OIF believed that these new systems had a positive impact on combat effectiveness. While the NCW hypothesis postulated a "dramatic" increase in combat power, the results shown in figure 5 reflect only a moderate increase in combat effectiveness.



*Figure 5. Combat Effectiveness*

Examples of new systems and the extended connectivity that are referred to in this finding include the following:

1. New information systems such as the Force XXI Battle Command Brigade and Below (FBCB2) using the Blue Force Tracker (BFT) L-band transceiver were fielded down to the maneuver company level, enabling a COP and unprecedented situational awareness as well as a limited beyond-line-of-sight communications capability.
2. A new sensor system, similar to the LRAS3, was fielded to the 3 ID (M) and incorporated into varied reconnaissance units, providing extended range day/night target acquisition and location capability.
3. Extended connectivity provided by increased bandwidth (25 kHz) for the single channel tactical satellite communications radios enabled widely dispersed commands to maintain clear communications connectivity from the brigade through corps level.
4. The Tele-Engineering kit gave the combat engineers a reach-back capability to access CONUS-based engineering expertise to help solve problems that exceeded their capabilities or time available.
5. The Movement Tracking System (MTS) provided the logisticians a capability to track convoys and a limited beyond-line-of-sight text messaging capability.

New systems on the whole provided commanders and staffs more relevant information and increased their situational understanding. These commanders and staffs in turn used this information advantage to increase their organizations' combat effectiveness. This finding supports the primary hypothesis (see paragraph 1.6).

**Finding 2. Increased connectivity and the flow of information at the brigade level and above provided an “untethered” ability to command regardless of location: “Battle Command on the Move.”**

“Command occurs at the location of the commander....Commanders lead. There is no ideal pattern of leadership or simple prescription for it; different commanders lead in different ways. Leadership is essentially creative. As far as operational conditions allow, leadership must be up front. Command must be forward. Commanders need to see their soldiers and soldiers must see their commander. Commanding forward allows commanders to assess the state of operations face-to-face with their subordinate commanders and their soldiers.”<sup>27</sup>

U.S. Army doctrine establishes that the corps and division generally employ three command posts: a tactical command post (TAC CP, also called the C-TAC at corps and D-TAC at division), a main command post (Main CP, also called the C-Main at corps, and D-Main at division), and a rear command post (Rear CP; also called the C-Rear at corps and D-Rear at division). These command posts are echeloned and are the principal facilities commanders use to control operations. The focus of the command posts also varies.<sup>28</sup>

The Corps TAC CP typically focuses on conducting corps close operations and monitors deep and rear operations only for their effect on close operations. The TAC is relatively mobile and can usually move with its organic capabilities.

The Corps Main CP has a broader orientation than the TAC and typically focuses on synchronizing the battle command system, providing continuity for corps operations, synchronizing the entire corps battle, conducting corps deep operations, and planning all future operations. The Main is relatively immobile and requires additional transportation support.

The Corps Rear CP typically focuses on command and control rear security operations, performing terrain management of the corps rear area, sustaining corps close, deep, and rear operations, and planning and controlling the corps' administrative movements.<sup>29</sup> Like the Main, the Rear CP is also relatively immobile and requires additional transportation support.

An assault command post (ACP) may also be created by the commander to be a flexible and rapidly deployable battle command element capable of conducting operations in a forward-deployed and austere environment. It may be temporarily employed while the TAC relocates.

Doctrine also points out that a commander cannot be a prisoner of a CP. Wherever the commander is on the battlefield, he must retain access to the information he needs to command.<sup>30</sup> During OIF, the commanders were enabled by new information systems and extended connectivity systems that freed them from the relatively static doctrinal CPs. Both the V Corps and 3ID (M) commanders availed themselves of quickly fielded and redesigned M-4 Command and Control Vehicles (M-

4 C2V). These vehicles offered armored protection and were equipped with information and communications capabilities that enabled commanders by providing them with the freedom to move to the points where they felt they could best get the feel of the battle and fulfill all of their command functions. In fact, both commanders established a permanent ACP and rarely operated from any of the other CPs.<sup>31</sup> Brigade commanders were also fielded with new Bradley Brigade Command Vehicles (BCV) that similarly allowed them to maintain effective command and yet operate free of any fixed CP.



*Figure 6. Battle Command on the Move*

“A command and control on-the-move capability was essential to the operation. Force XXI Battle Command Brigade and Below, wide-band single-channel TACSAT [Tactical Satellite Radio: Spitfire], and mobile command posts were the enablers.”<sup>32</sup> The connectivity provided by the single channel wideband TACSAT (AN/PSC 5 Spitfire), the situational awareness and connectivity provided by the FBCB2, and the modified and quickly fielded mobile command carriers allowed the commanders, most notably the V Corps and 3 ID (M) commanders, to move about the battlespace and maintain command anywhere in the battlespace—the commanders were “untethered.”

It is likely that 3 ID (M) C2 and operations would have been different without this battle command on-the-move capability. For example, during the initial operations from 21-29 March 2003, the division had most if not all of its C2 nodes completely on the move (it should be noted that the D-TAC was also operating out of M-4 C2Vs).<sup>33</sup> MG Blount stated that the newly fielded TACSAT systems, C2Vs, and FBCB2/BFT allowed the division to break away from the National Training Center (NTC) mindset where CPs are typically leapfrogged to maintain C2 and allowed the division to operate widely dispersed and on the move thus increasing the tempo of operations.<sup>34</sup> Compare the 3 ID (M) commander in his ACP with that of the 1st Marine Division commander where the CG

“commanded the division via one HMMWV (High-Mobility Multipurpose Wheeled Vehicle) and two aides who remained with him throughout. One aide kept the batteries in his IRIDIUM charged, the other rubbed out red icons on the map. He commanded via the IRIDIUM and the map on the side of his HMMWV. He would talk to regimental commanders on the insecure IRIDIUM using veiled speech only.”<sup>35</sup> Certainly, there is little doubt which commander had greater connectivity with a near-real-time situational awareness and understanding of the battlespace.

Finally, this battle command on-the-move enabled commanders to exhibit even greater leadership and allowed them to shift from merely positioning forces to the art of orchestrating the effects of those forces as espoused in Force XXI Operations (TRADOC Pam 525-5, Aug 1994).

**Finding 3. Information systems are not a substitute for leadership; they help good leaders make better decisions “quicker.”**

“Leadership is influencing people—by providing purpose, direction, and motivation—while operating to accomplish the mission and improving the organization (FM 22-100). It is the most important element of combat power. As the senior leader of the command, the commander directly applies that element of combat power. Subordinate commanders and small unit leaders reinforce it.”<sup>36</sup> “Leadership and the warrior ethos sustain soldiers during the brutal realities of combat and help them cope with the ambiguities of complex military operations.”<sup>37</sup>

“Commanders are the key to command and control. They execute the art of command with the science of control. They create a positive command climate to inculcate and foster trust and mutual understanding. Commanders visualize the battlespace, describe their visualization to subordinates, and direct actions to achieve results.”

— FM 6-0 Mission Command: C2 of Army Forces

[New information systems and increased connectivity provided] “significant advances in the art of battle command.”

— LTG Wallace, CG, V Corps

“Commanders still had to accept uncertainty and not hesitate in making decisions instead of waiting on more analysis or information; intuition and audacity were important.”

— Survey respondent

“Commanders still needed to locate where they could feel and smell the battle, sense the morale of the soldiers—their pride and pain—and work with subordinate commanders in developing future operations.”

— Survey respondent

“Blue force tracker certainly increased my combat awareness and helped me make better decisions quicker.”

— LTC Marcone, Cdr, TF 3-69 AR, 3 ID

*Figure 7. Leadership*

The role of information technologies and systems is to improve our ability to collect and store data, process and analyze it to create information, and distribute this information widely.<sup>38</sup> The information environment helps provide more accurate relevant information in a more timely fashion. This increased fidelity of information helps leaders achieve situational understanding and assists in their decision-making process (see figure 7).

“The quality of leadership and decision-making in OIF—from the highest to lowest levels—is striking. Soldiers and leaders demonstrated courage, compassion, initiative, and sacrifice.... Leaders led from the front and made decisions based not only on enhanced command and control tools afforded by comparatively high levels of digital linkage, but also by seeing for themselves the conditions on the battlefield.”<sup>39</sup>

On the whole, commanders stated that they made better decisions more quickly because of the timeliness and accuracy of information they had readily available to them (see figure 8 on faster decision-making). The information systems did not make the decisions. There was still plenty of fog and the friction that results from the reaction of the enemy and from the physical environment. Commander-to-commander interactions were an important factor in reaching decisions quickly and were enabled by the connectivity and information systems that allowed them to communicate and work off of a shared COP and shared understanding.

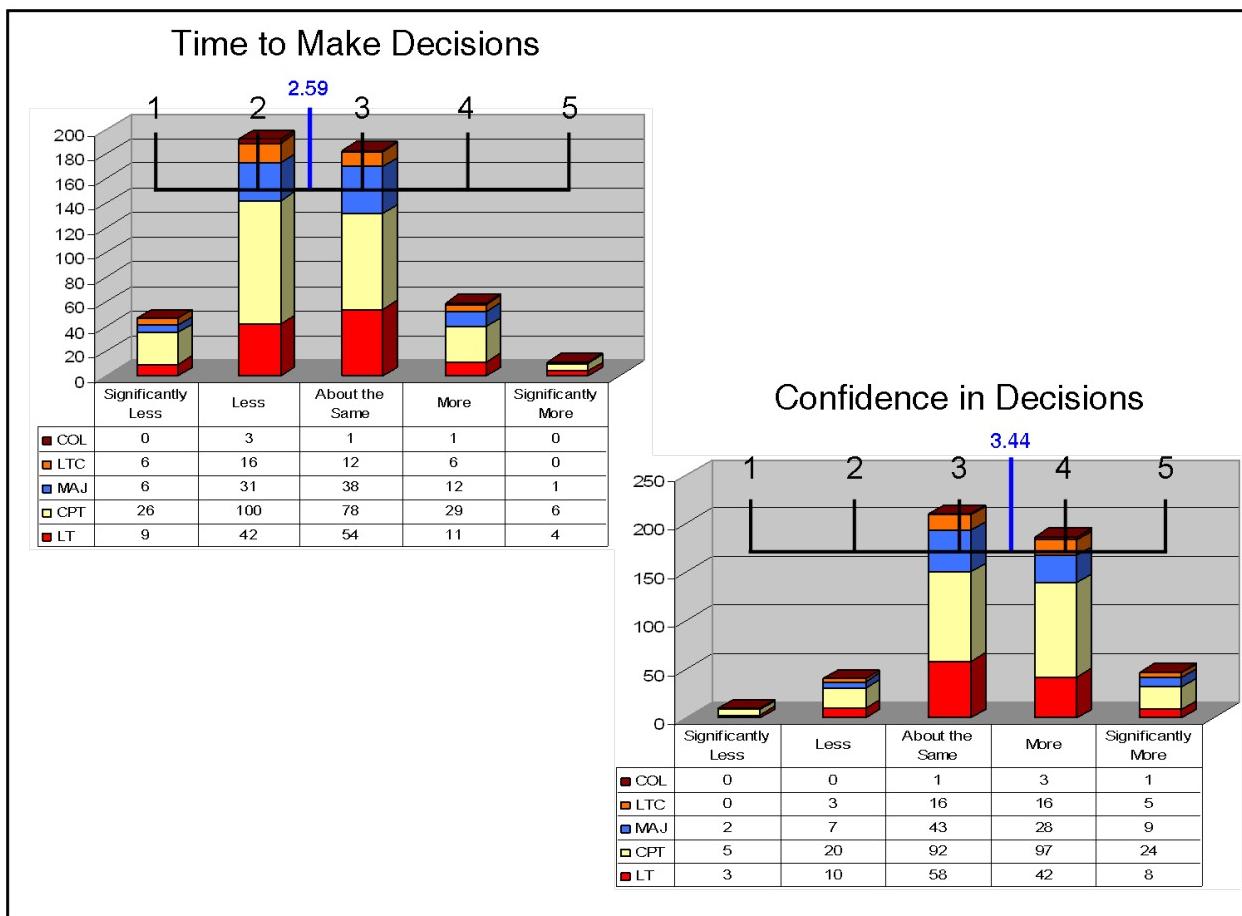


Figure 8. Speed and Confidence of Decisions

It is interesting to note that the *information systems did not flatten the hierarchy—experience and knowledge were important as well as the frame of reference of the commander.* The battlespace knowledge at the higher level commands, division and corps, is not only the result of increased information system capabilities but also, and more importantly, the result of the experience of the commanders and staffs. This does not appear to follow the NCW assumption that “rather than being hierarchical, network-centric warfare assumes a flattened command structure with a rapid decision cycle.”<sup>40</sup>

Also, most commanders stated that their decision-making process changed to directed courses of action (COAs) because of the high level of situational understanding they experienced; staffs then worked to support those decisions instead of developing COAs. This is the essence of execution-based decision-making and supports what the proponents of NCW theory postulated when they wrote, “Knowledgeable actor entities will alter the approach to C2 from a process that embeds plans and decisions to a process of broad intent and orchestrating support of executing entities.”<sup>41</sup>

Finally, in both the survey and during the interview process, decision-makers with new information systems and extended connectivity systems had great confidence in their decisions. This increased confidence stemmed from several factors: information available to the decision-maker, trust in the subordinates who would execute the missions as a result of the exercises and rehearsals that built the cohesive teams, the lethality and survivability of the weapons platforms, and the knowledge that the enemy was largely ineffective against the maneuver forces executing the offensive.

An interesting note of the leadership finding is that, while the netted technologies enabled information to move outward (certainly limited due to connectivity and the numbers and types of information systems), there did not appear to be micromanagement from the upper tactical echelons. This is an indicator of strong, confident senior leaders and the sense of trust in subordinate commanders as well as echeloned responsibilities. With the continual flow of forces entering the operation, the echelonment of responsibilities was exceptionally important. The close fight and tactical engagement were still conducted at brigade and below and mostly in the present, while the division was setting the plans for and shaping the next tactical employment of its forces out 24-48 hours. The corps was planning out up to 96 hours, conducting shaping operations to support future battles, and planning on the employment of units entering the formation. These divisions of responsibilities allowed the respective commanders to maintain their focus and to establish a clear intent for their subordinate commanders.

#### **Finding 4. The new information environment enhanced the execution and effects of joint precision fires and maneuver.**

NCW thought proposes that by “Using network-centric concepts and enabling technologies, we can achieve a very high degree of coupling between C2 and fire control. This tight coupling enables us to translate high levels of shared battlespace awareness into increased combat power.”<sup>42</sup>

New sensors and information systems improved the overall information environment, and they enhanced the execution and effects of both fires and maneuver. The combination of responsive air with artillery enabled the corps and division to effectively disrupt the ability of the enemy to focus his combat power. The new information environment encouraged maneuver aggressiveness or

boldness synchronized with precision fires. The effects of both were devastating on enemy forces. Examples of how this worked are discussed below.

The fire support community silenced enemy artillery systems. Using Q-36 and Q-37 counterfire radars, the fire supporters rapidly acquired precise data on enemy artillery firing positions and, using the Automated Deep Operations Coordination System (ADOCS), were able to conduct quick analysis and coordination of the counterfire acquisitions and rapidly assign the counter-battery missions to the most responsive and effective fire support means available. This rapid counterfire capability enabled relatively unfettered freedom of maneuver.<sup>43</sup>

Dr. Kirkpatrick, V Corps Historian, points out that “OIF broke fresh ground in a number of areas, but perhaps none so important as the conduct of joint operations. Air support operations of V Corps demonstrated combined-arms thinking applied at the next tactical level because the two forces not only used joint fires to establish the conditions that enabled ground maneuver, they used maneuver to establish the conditions that enabled joint fires to have dramatic battlefield effects. Within V Corps, this was accomplished by the total integration of Army and Air Force intelligence and targeting, plus the complete trust each service reposed in the other.”<sup>44</sup> An example of how the corps conducted shaping operations involved using the Hunter UAV to find targets in the designated areas. As targets were developed, they were displayed on ADOCS, where the coordination and approval process was rapidly conducted and targets were assigned for servicing, a process described as a kind of a “jump ball” between the artillery and air. Close Air Support (CAS) was usually the most responsive and available for these type targets, and the corps’ Air Support Operations Group, through its Air Support Operations Center (ASOC), used the UAV feeds to direct CAS onto enemy targets anywhere in the corps battlespace.<sup>45</sup> “Throughout OIF, air support had a major impact on the battlefield. Air support proved highly successful both in shaping operations as well as the close fight....Responsiveness, lethality, and integration into maneuver contributed to the success of CAS on the battlefield.”<sup>46</sup> Figure 9 reflects the increased effectiveness of air when integrated as CAS.

Enemy Strength Summary			
	BEFORE OIF	AFTER AI/KI SHAPING	AFTER CORPS SHAPING
11th DIV	84%	81% After 1.5 Days	63% After 3 Days
MEDINA RG DIVISION	96%	92% After 4.5 Days	29% After 10 Days
HAMMURABI RG DIVISION	97%	73% After 13 Days	23% After 5 Days

CENTCOM G2 assessment after Theater BDA assessment corrected backwards (by CENTCOM)

Figure 9. Effects of Air Operations

Maneuver commanders from the company level and up stated that the information provided by new sensors such as the LRAS3 increased their situational awareness and that the FBCB2/BFT increased their situational awareness to such a degree that they were able to maneuver "smarter." This increased situational awareness enabled commanders to better conduct complex maneuvers such as link-ups and passage of lines even under the most difficult of conditions, e.g., at night and during sand storms, and to better synchronize the effects of fires to enhance their maneuver. They also stated that the increased situational awareness boosted their confidence and emboldened their maneuver. Figure 10 contains comments that were common concerning the effects of the information environment on mission execution.

"BFT allowed us to move much faster than anyone expected. It allows higher level commanders to make decisions rapidly."

— Survey respondent

"In terms of precision capability, the LRAS3 and Paladin combination was amazing. This was a capability we didn't have before this war; you could now observe with the accuracy of eight to ten digit grids and call that into a DS artillery that also had pinpoint accuracy of their location so that you got the ability to put first rounds on target...."

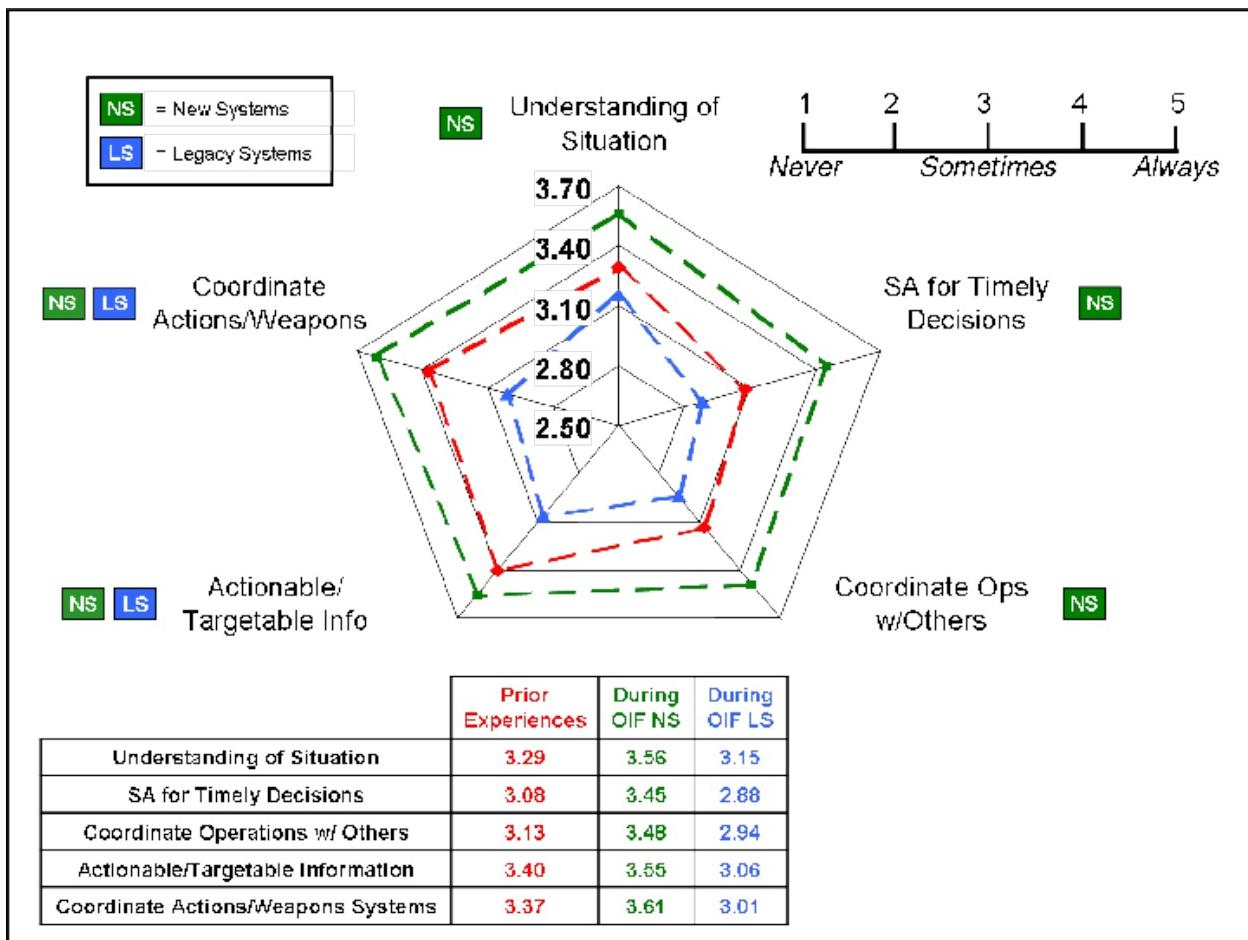
— COL Allyn, Cdr, 3 BCT, 3 ID(M)

"We saw ones and twos instead of the masses of tanks and infantry or artillery RAGs or DAGs; this is what we had to go for. That was the only kind of target arrays we had. That is what made precision fires and the Air Force so important. We would find something and send the Air Force in to kill it."

— COL Janosko, Cdr, V Corps Artillery

*Figure 10. Enhanced Execution and Effects*

Figure 11 indicates that the survey respondents believed that the new information systems allowed them to have a better understanding of the situation in a timelier manner, allowing them to share actionable and targetable information and to coordinate the effects of maneuver and fires more effectively than in any previous experience. This contributed to a significant increase in coordinated effort and in the effects of precision fires. The second order affects of the increased precision and effects of the fires were to reduce the demand on an already over-burdened logistical system. The increased precision of target locations and new munitions like SADARM and JDAM meant fewer rounds were needed to accomplish the same result. The increased use of CAS also meant that fewer artillery munitions were needed; however, it should be pointed out that CAS was considered ineffective for counter-battery purposes, as it was the least responsive and had too many control restrictions.<sup>47</sup>



*Figure 11. Increased Coordination from Situational Awareness*

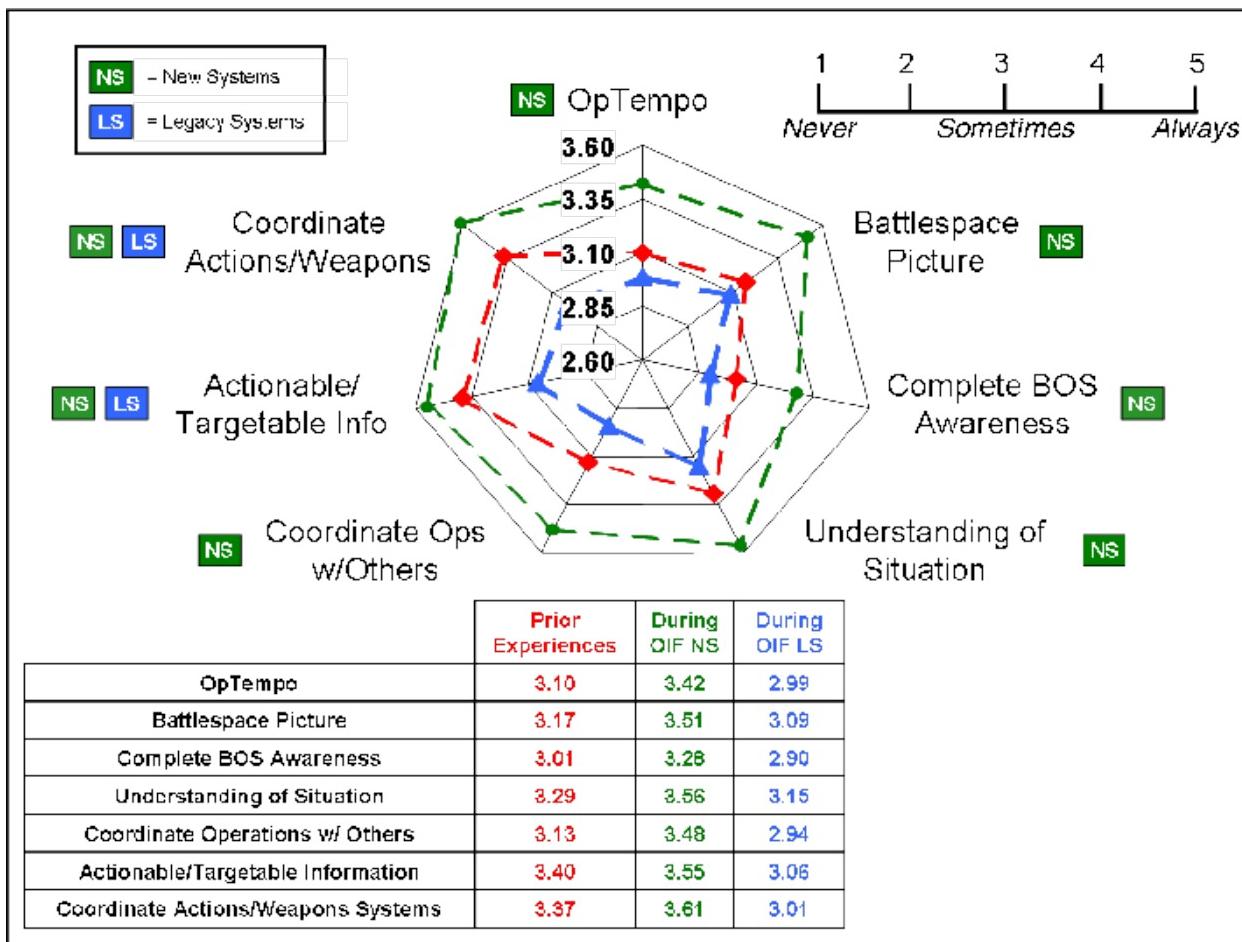
**Finding 5. Increased information and situational awareness allowed more positive management of the battlespace.**

“Battlespace is the environment, factors, and conditions commanders must understand to successfully apply combat power, protect the force, or complete the mission. This includes the air, land, sea, space, and the included enemy and friendly forces, facilities, weather, terrain, the electromagnetic spectrum, and the information environment within the operational areas and areas of interest.”<sup>48</sup>

NCW theorists state that “battlespace awareness must be viewed as a collective property (a type of collective consciousness). It does not exist at just one place (node) in the battlespace, but rather at all relevant nodes in the battlespace—across echelons and functional components.”<sup>49</sup> The theorists appear to be describing a type of hive mentality—like Star Trek’s infamous race of “Borg”—wherein a collective consciousness affords instantaneous adaptations and responses to a hostile environment.<sup>50</sup>

Those operating in the enhanced information environment provided by new sensors, enhanced connectivity, and new information systems were better able to manage the battlespace environment during OIF than during previous experiences. Also, those not operating in this enhanced information environment experienced a lesser ability to manage their battlespace environment.

“Conducting continuous operations over extended distance on today’s complex battlefield is not possible without a clear definition of the battlespace. This could not have been accomplished without TACSAT and FBCB2.”<sup>51</sup>



*Figure 12. Battlespace Management*

Figure 12 illustrates those areas of battlespace management elements that were measured as part of the survey. The innermost line represents those who did not have new information systems in their organizations. The middle line represents the pre-OIF base line for all respondents. The outer line represents those who had new information systems in their organizations. Note that in all cases those with new information systems believed they were more aware of the battlespace environment and better able to respond to the environment. Those who did not have access to the improved information environment provided by the new technologies actually believed their capability to react to the battlespace environment was worse than their previous experiences and expectations with respect to the seven measurable areas depicted in figure 12.

**Finding 6. Interaction and/or correlation of information sources are required to gain situational understanding. “Battlefield Visualization”**

Battlefield visualization is the process in which “the commander develops a clear understanding of the current state with relation to the enemy and environment, envisions a desired end state that represents mission accomplishment, and subsequently visualizes the sequence of activity that moves the commander’s force from its current state to the end state.”<sup>52</sup> This concept lies at the center of battle command and is the “mental process which supports the commander’s decision-making process.”<sup>53</sup> Therefore, battlefield visualization is a cognitive endeavor and is more art than science. It is learned and gained through training, exercises, wisdom, and available information from all sources (human and technological). Battlefield visualization depends on experience and intuition to determine relevant or critical information available in order to gain situational understanding, clearly discern a desired end state, and see and understand the dynamic relationship between the opposing forces. Battlefield visualization allows commanders to decide when to shift the main effort, to change priorities, to reinforce, to request additional forces, or to disengage.<sup>54</sup>

NCW theorists address battlespace awareness and battlespace knowledge:

1. Battlespace awareness “results from the fusion of key elements of information which describe or characterize the battlespace. The elements are primarily explicit information (e.g., position of forces, geography, and weather). This type of information needs little interpretation and usually can be communicated quickly and easily. The vast majority of information in the [COP] is explicit information.”<sup>55</sup>
2. Battlespace knowledge consists of tacit information, which requires interpretation. Tacit information includes capabilities and tactics, local customs, and intent; it is people-centric.<sup>56</sup>

In order to gain the degree of information necessary to achieve a battlefield/battlespace visualization/knowledge, it took more than the information provided by the COP. The COP was able to provide situational awareness, which was extremely valuable, but a blue icon is only that until it is put into some kind of context. To have situational understanding of the blue icon took additional information, usually in the form of a voice or text report (multiple sources, voice broadcasts, icons from different sources, e-mail, and chat—using established information system chat rooms—were all important in providing a complete picture). “A picture is worth a thousand words, but a picture and a few words provide the context of the picture.”<sup>57</sup> Cross referencing between COP screens was also necessary, as each provided different information that needed to be mentally assembled to have a more complete level of situational awareness (e.g., C2PC would reflect BFT and air tracks—important for the maneuver picture, JDLM (Joint Deployment and Logistics Model) would reflect MTS and DTRACS (Defense Tracking Reporting and Control System)—important for tracking logistics convoys, and ADOCS would reflect the fires information). Figure 13 provides comments that illustrate the need for more than one source of information to achieve situational understanding and battlefield visualization.

“Blue force tracker has to be complemented by voice to fully understand the situation; otherwise you only have geographic position awareness of blue forces.”

— Survey respondent

“When you put voice against pictures you can really put together a decent picture—a real understanding.”

— LTC Mowers, G-2, 3 ID (M)

“For SA and command and control functions from the Corps Main you needed multiple feeds: ADOCS, ASAS, C2PC, and voice communications provided by wideband single channel TACSAT.”

— BG Hahn, CoS, V Corps

“I saw more of the battlefield than I ever expected.... Not since the days of Napoleon [when he could see the entire battle from his position] had senior commanders been able to see all of their forces on the battlefield.”

— LTG Wallace, CG, V Corps

“Blue icons are only that, you have SA but need something else to understand what is going on, most usually that is a voice transmission.”

— Survey respondent

*Figure 13. Battlespace Visualization*

**Finding 7. Voice communications were the primary means of gaining situational understanding and ensuring unity of command and effort at all levels.**

“Voice communications over INFOSYS [Information Systems] (including telephone, combat net radios, trunk communications, and satellite communications) continues to be a principal method of directing. Commanders can transmit and explain the commander’s intent best by voice. It is common to all levels of command and is the only communications method that permits the commander to project personal willpower and inspiration at a distance. Voice communications are especially useful during execution, particularly during fast-moving operations that preclude face-to-face contact. Such communications help maintain tempo.”<sup>58</sup>

Voice provided much that was not obtainable from a visual representation like the C2PC or from text messages. Voice communications provided the sense of urgency through the tenor and tone of the person talking and helped the listener more quickly understand the meaning of what was being communicated.

Comments like “The wide-band single-channel TACSAT won the war for us. This was the only reliable means of long range communications and my primary situational awareness tool” were common during the interviews and also as comments in the survey. The use of the TACSAT for command nets at the corps and division created a “fishbowl” effect, where anyone able to monitor the net gained increased situational awareness and understanding. In this case, those authorized to use the command net were inside the fishbowl, and those with access were on the outside gaining an

understanding by monitoring those in the fishbowl. At the brigade-level and below, FM radio was the primary means of gaining situational understanding and remains the most widely distributed connectivity system at that level. Many unit commanders referred to their units as “push to talk.”

“During actual combat operations, the FM backbone was our C2 platform. FBCB2 provided critical real-time situational awareness....”

— Survey respondent

“We were a push-to-talk unit and conducted all of our operations off a set of battle drills executed over FM.”

— Survey respondent

“Again, don’t skew the data and draw improper conclusions...some systems only go down to a certain level...data eventually ends up originating or terminating with a phone call or FM transmission.”

— Survey respondent

“Spread over 300 KM, as we usually were, we had to rely on the TACSAT for our updates, and this allowed all the other commanders to hear and participate at the same time.”

— MG Blount, CG, 3 ID (M)

“TACSAT was our push-to-talk Corps command net; something we did not have before... what was important was hearing what was going on ... I would rather see a picture and hear a description of what is going on.”

— LTG Wallace, CG, V Corps

*Figure 14. Voice Communications*

For units with new information systems, the increased situational awareness provided by the COP changed the nature of voice communications to some degree. In other words, there was less need to collect information as to where units were located, thus allowing communications to begin with a higher level of cognitive awareness.

#### **Finding 8. Increased situational awareness had a significant positive impact on risk taking.**

“Mission command requires commanders who take calculated risks, exercise initiative, and act decisively—even when the outcome is uncertain. Because uncertainty exists in all operations, every decision involves risk. Among the key elements of the art of command are deciding how much risk to accept and minimizing the effects of accepted risks. All techniques for reducing uncertainty take time; commanders must accept risk and act. Commanders can reduce risk by foresight and careful planning. However, military judgment is required to determine whether the risk is worth taking. Ultimately, the willingness to take calculated risk stems from the commander’s character.”<sup>59</sup>

In figure 15, the survey respondents who had new information systems in their organizations indicated that the situational awareness they had provided greater risk awareness than they had

previously experienced. In other words, they believed they had a greater level of awareness of the risks associated with courses of actions they may take.

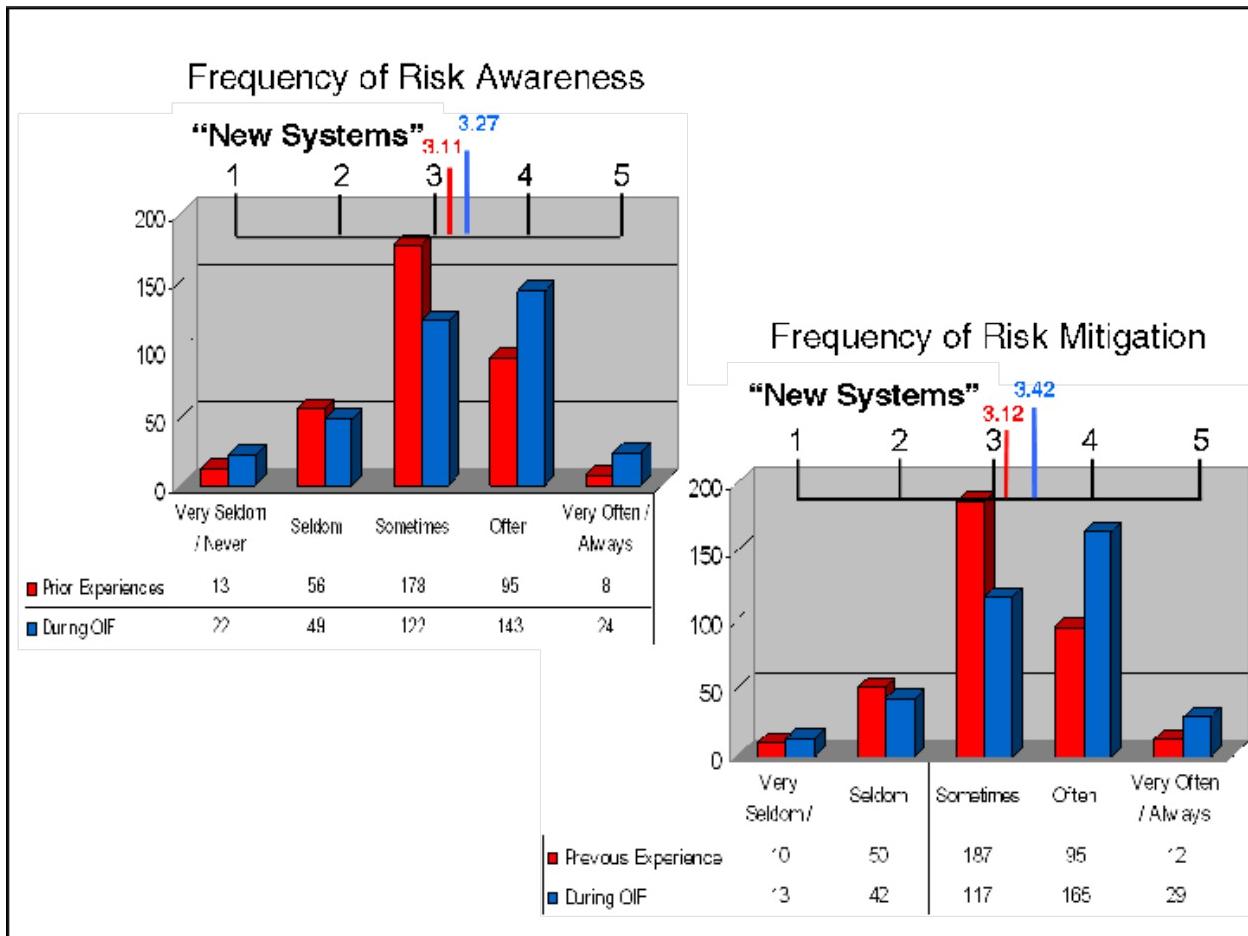


Figure 15. Risk Awareness and Mitigation

Figure 15 also indicates that the survey respondents believed that the increased situational awareness and risk awareness enabled them to take measures to mitigate or reduce those risks. Interviews confirmed the survey results.

“Commanders evaluate whether the command can recover if they decide wrongly or if it will be in a position to seize an unexpected advantage over the enemy.”<sup>60</sup> “Seizing the initiative often requires accepting risk. Commanders and staffs evaluate enemy and friendly actions to determine who has the initiative. They determine what friendly actions will enable friendly forces to retain and exploit the initiative if they have it and seize the initiative if they do not.”<sup>61</sup>

“Understanding yourself, and the FBCB2 gave you this picture, allowed you to take risk because you knew who was at your back; therefore, you would move under conditions that otherwise would make you hunker down or move much more cautiously.”

— LTC Mowers, G-2, 3 ID (M)

“Increased situational awareness and the lethality of our systems gave me the confidence to take additional risk....”

— MG Blount, CG, 3 ID (M)

Having situational awareness and understanding allows you to operate with “... less risk involved, but that also might imply that you are willing to take more risk. Because you have this high transaction rate...you can make a mistake and recover from it quicker than the enemy can understand that you made a mistake in the first place, and there is a fair amount of confidence in risk taking that is associated with that.”

— LTG Wallace, CG, V Corps

*Figure 16. Risk Tolerance and Acceptance*

Figure 16 contains some of the comments provided during the interview process. Generally, those interviewed indicated that, because of their level of situational awareness and understanding, they felt emboldened and were able to accept more risk than they might have otherwise.

We found that risk tolerance and acceptance were influenced by the increased velocity of the information feedback loop or speed of command, which is a characteristic of the Information Age, also known as “Twitch Speed” (this twitch speed refers to the cognitive ability to rapidly understand and respond to volumes of information, as is common for interactive video games). This increased risk tolerance is reflected in maneuver boldness and audacity. As a result, risk reduction, based on twitch speed, actually allows for greater economies of force.

#### **Finding 9. Increased situational awareness reduced fratricide.**

FM 1-02/MCRP 5-12 A defines fratricide as the unintentional killing or wounding of friendly personnel by friendly firepower.

FM 3-0 addresses protection as the preservation of the fighting potential of a force so the commander can apply maximum force at the decisive time and place. Protection is further divided into four components: force protection, field discipline, safety, and fratricide avoidance.

“The destructive power and range of modern weapons, coupled with the high intensity and rapid tempo of combat, increase the potential for fratricide. Tactical maneuvers, terrain, and weather conditions may also increase the danger of fratricide. Commanders seek to lower the probability of fratricide without discouraging boldness and audacity. Good leadership resulting in positive weapons control, control of troop movements, and disciplined operational procedures contributes

to achieving this goal. Situational understanding and using friendly personnel and vehicle identification methods also help. Eliminating fratricide increases soldiers' willingness to act boldly, confident that misdirected friendly fires will not kill them.”<sup>62</sup>

Theorists state that a goal of NCW is to achieve a reduction in fratricide while minimizing the constraints placed on weapons by making actors more knowledgeable (of their battlespace) and their weapons smarter by providing them with more information.<sup>63</sup>

This study did not directly seek data concerning the relationship between situational awareness and fratricide or friendly fire reduction. However, the anecdotal evidence provided by unsolicited survey comments and information collected during the interview process suggests that increased situational awareness, primarily seeing other blue forces as provided by BFT, allowed commanders to make smarter maneuvers and reduce unexpected encounters with other friendly forces. This high level of blue force situational awareness enabled units to conduct complex maneuvers under adverse conditions with less risk of friendly fire (e.g., passages of lines and link-ups). Link ups between maneuver forces and Special Operations Forces (SOF) were also enabled by blue force tracking (note that the SOF BFT locations were filtered so as not to be visible outside of SOF channels). To prevent fratricide, the Special Operations Coordinator (SOCOORD) would dispatch SOF personnel—based on the BFT tracks—to coordinate with the maneuver forces prior to a link-up with forward placed SOF teams.

“Blue Force Tracker saved lives. Without it, I know I would have lost soldiers due to friendly fire.”

— Survey Respondent

“FBCB2 saved lives. Can safely conduct fire and maneuver. Excellent planning tool for on the move. Essential for recon movement, and commo.”

— Survey Respondent

“Blue force tracking—an absolute must on a violent, ever changing battlefield and CS/ CSS units do not get FBCB2, so it was a constant challenge to ensure we had SA on all blue (and red forces). We had one blue on blue engagement because of poor SA.”

— LTG Wallace, CG, V Corps

“FBCB2s allowed me to see friendly forces on the battlefield—a huge improvement over OPERATION DESERT STORM. It helped to prevent fratricide, and chatter on radio nets.”

— Survey Respondent

“Friendly Forces: needed to know which elements were moving through our assigned sectors so as to prevent fratricide.”

— Survey Respondent

“Where the friendly units were using my FBCB2 or Blue Force Tracker, it truly prevented fratricide in my opinion on several occasions.”

— Survey Respondent

*Figure 17. Fratricide Mitigation*

Figure 17 provides a sample of some of the comments from the survey pertinent to fratricide prevention.

**Finding 10. Information systems and the “richness” they provided changed the way upper echelon staffs functioned.**

When NCW theorists address information richness or quality they list eight attributes that they believe measure the important elements of information richness. The eight elements are: completeness, correctness, currency, accuracy or precision, consistency, relevance, timeliness, and assurance.<sup>64</sup>

For the purposes of this study, information richness included the following ten attributes:

1. An accurate picture of the battlespace or COP, to include a presentation of joint forces.
2. Accurate and timely information that provided a complete awareness of the BOS.
3. The degree to which the quantity, quality, and timeliness of information allowed for the ability to modify plans prior to execution.
4. The degree to which the information available allowed for situational understanding.
5. The degree to which information systems assisted in sharing information that was actionable (actionable information is information that is relevant to and appropriate for the users receiving it, information that they can easily assimilate to enable them to perform their tasks, usually enabling better and more efficient decision-making) and targetable (meaning that the information provided a valid target, with the recipient being capable of taking action against the target).
6. The degree to which information systems enabled the ability to coordinate the actions of weapons systems.
7. The degree to which information systems enabled the ability to coordinate actions and/or operations with other units, organizations, and services.
8. The degree to which information availability provided a situational awareness that enabled faster decision-making.
9. The degree to which information availability provided an awareness of the risks involved with any decision or course of action.
10. The degree to which information availability allowed for actions to mitigate the risks of any associated decision.

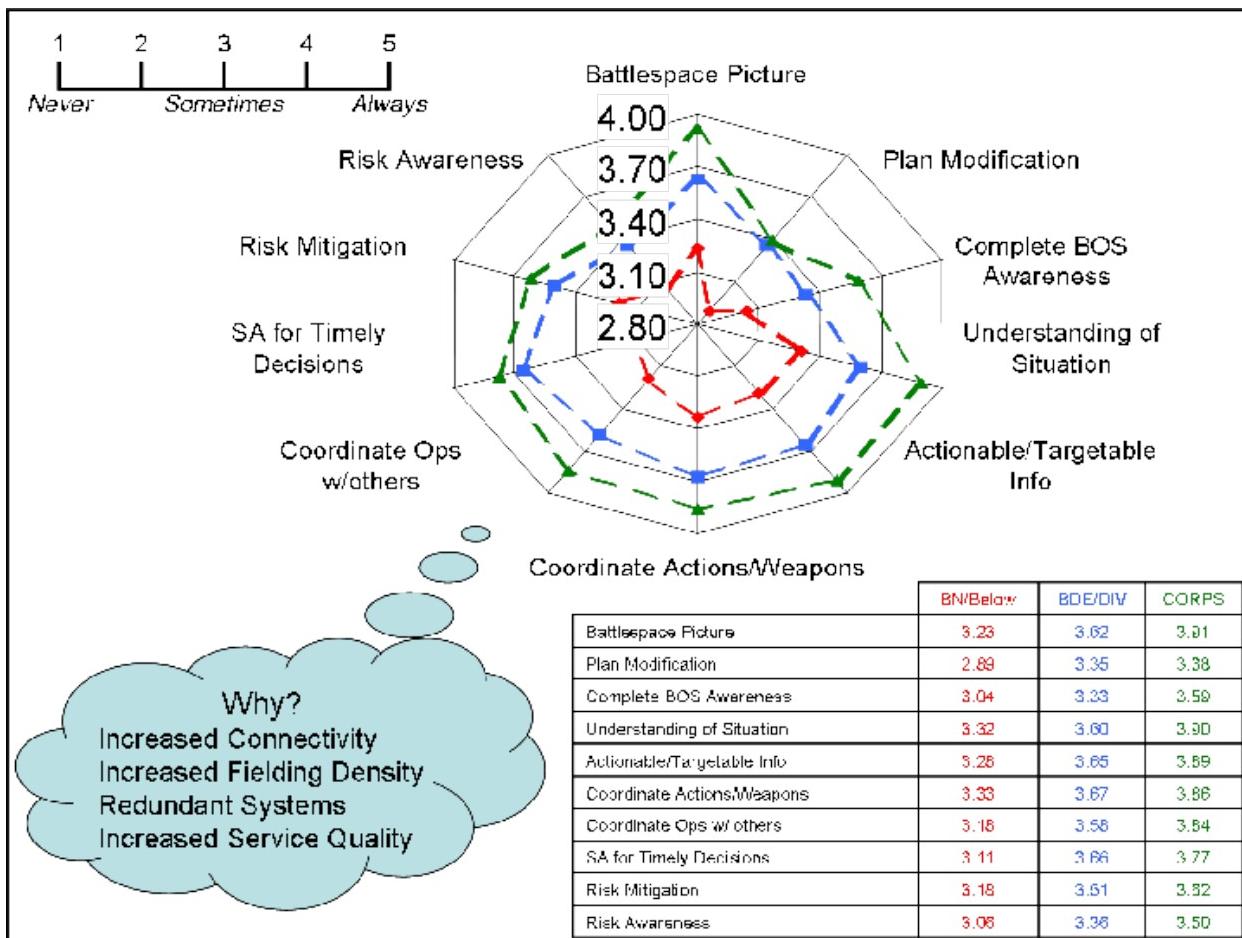


Figure 18. Information “Richness”

Where the staff had supporting information technologies, most notably at the corps and division levels, there were economies in time. The staff’s role shifted from collecting data and preparing reports to analyzing and synthesizing information provided by multiple information systems in accordance with the priorities specified or implied in the commander’s intent. This enabled the staff to better anticipate and facilitate future requirements.

“I was able to spend more time on more important areas because of the situational awareness from our C4ISR systems.”

— COL Hicks, G-3, V Corps

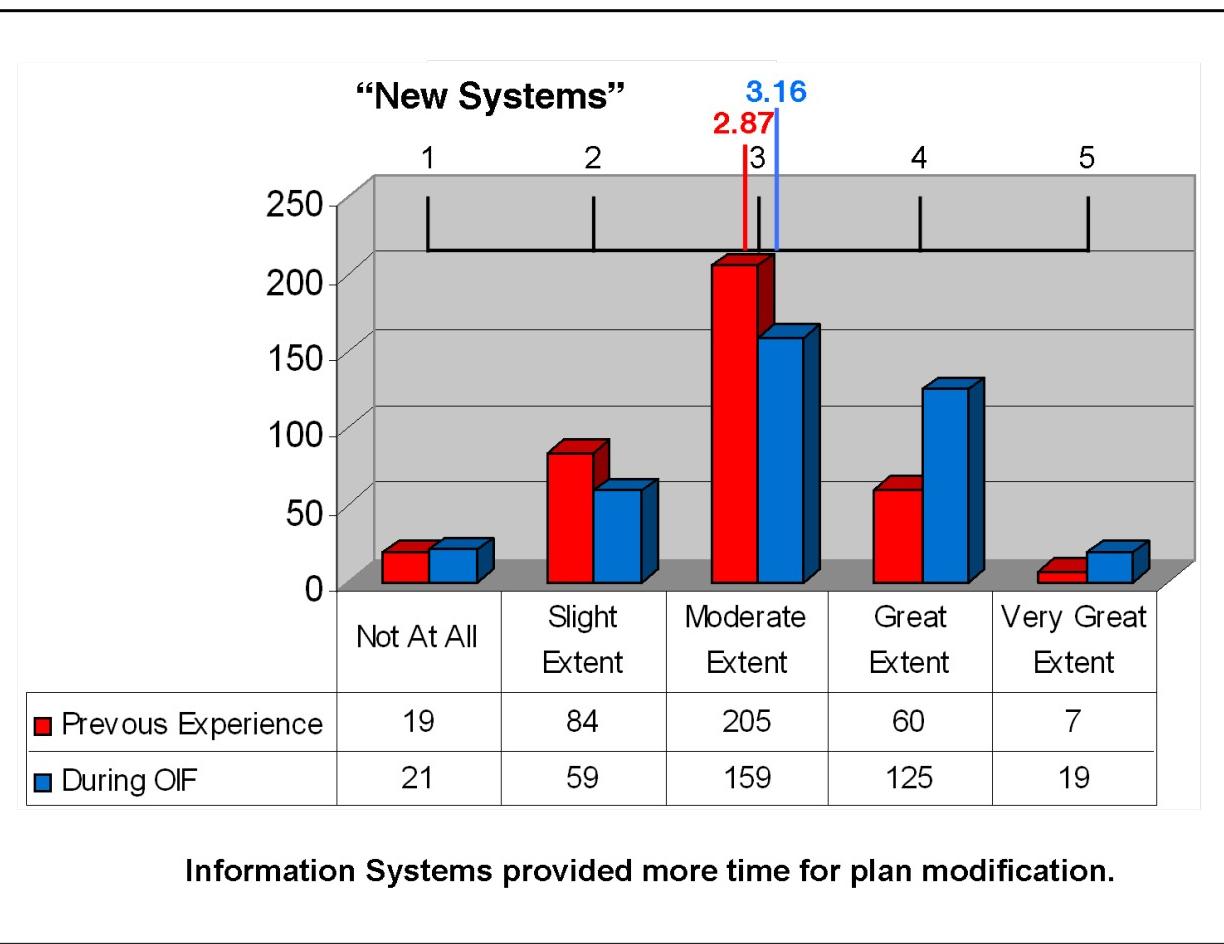
“We did more analysis of information and less time on data collection. We still had to filter the information because of the volume.”

— COL Brown, G-3 CHOPS, V Corps

“Information systems and TACSAT monitoring reduced the amount of talk—reduced the amount of information requested and increased coordination and planning.”

— LTG Wallace, CG, V Corps

Figure 19. Time for Analysis



*Figure 20. Plan Modification*

**Finding 11. Even a limited fielding of information/connectivity systems provided value added, but only when the limited systems were leveraged.**

One of the central tenets of the NCW hypothesis concerns the need for a “robustly” networked force to achieve the necessary changes to information sharing that will ultimately result in a dramatic increase in mission effectiveness.

The term “robust” was not quantified for this study. The information and extended connectivity systems used by V Corps and 3 ID (M) constituted immature networks and were not robust, yet even these immature networks provided increased situational awareness and understanding that resulted in increased combat effectiveness. The degrees of increased situational awareness and understanding were not merely the result of the new technologies, but more importantly, a function of the initiative and innovation of the people and organizations that adapted to the technologies and then maximized the value of those technologies, resulting in improved mission effectiveness.

The story of the MTS is an excellent example of how the 3 ID (M) Division Support Command (DISCOM) leveraged the capability of the few systems they had (19 fielded out of 384 expected/authorized). Again, the system, like the BFT for maneuver units, was fielded after the unit arrived in Kuwait. In this case, officer initiative and innovation were key in placing these few systems in

the nodes necessary to track critical logistical resources and requirements. During combat, the MTS proved to be the most reliable communication system within the DISCOM, even though the MTS is limited to approximately 120 characters of text messaging capability. The logisticians developed brevity codes for logistics status and were able to send messages to convoys concerning enemy activity along routes and to provide information necessary for the delivery of critical supplies. MTS provided situational awareness to the division transportation officer and movement control officer and enabled them to quickly and consistently transmit requirement and monitor convoy movements. This system and the Iridium satellite phones provided the only means to communicate with logistical convoys.

This story of the MTS is in sharp contrast with that of the U.S. Marine Corps and the UK forces, with their immature or limited fielding of BFT. The UK forces had a very late installation of 47 BFT systems, and none of their commanders were experienced with any such information systems or their potential. Given the lack of training and of any time to develop a sense of how they might use this new capability, the UK forces largely did not leverage any meaningful advantage from the BFTs they received. Reportedly, the U.S. Marines only used the BFT's extended connectivity to pass text messages when other systems were degraded due to line-of-sight limitations. There was no evidence in the written materials that they used the FBCB2 and the displays for increasing their situational awareness.<sup>65</sup>

“I had MTS in my vehicle and it was invaluable throughout the war... It was how we communicated the CSS needs of the brigade.”

— Survey Respondent

“MTS was the most dependable system regarding movement information, but we did not have a sufficient number of systems.”

— Survey Respondent

“The MTS system was invaluable during the maneuver phase of the war. We outran the ranges for FM comms, and moving retrans was strained at best.”

— Survey Respondent

“The thin fielding of FBCB2/BFT (2/co/trp) provided the friendly locations. Seeing these with some degree of accuracy was essential to maintain a current situation awareness.”

— Survey Respondent

“Iridium phones were a force multiplier.”

— Survey Respondent

*Figure 21. Limited Fielding*

Initiative and innovation are the key factors for deriving increased situational awareness and understanding when only a limited number of systems are available within an incomplete or immature network.

**Finding 12. Training, exercising, and rehearsing with information systems are vital for commanders, staffs, operators, and organizations.**

“Whatever the age or technology, the key to effective C2 is people using information to decide and to act wisely. Whatever the age or technology, the ultimate criterion of C2 success is always the same: acting faster and more effectively than the enemy to accomplish the mission at the least cost to the friendly force before the enemy can effectively act.”<sup>66</sup>

Individual training and education are required to develop skill and familiarity with information systems in order to adequately leverage all available information.

Like any other new system, individual training is required for all personnel who use information systems. Individuals, including even the most senior commanders, must be trained to understand what information is available and how to pull the maximum relevant information from the system. Commanders in particular must understand not only what information is available but also what is not available from the information systems.

The use of information systems requires collective training, exercising, and rehearsing in order to develop familiarity, cohesion, and teamwork. An atmosphere of trust must be developed that encourages information sharing. The collective training, exercising, and rehearsing should lead to the development of C2 procedures that result in simplicity and speed—procedures simple enough to perform quickly and smoothly under adverse conditions and efficient enough to increase operational tempo.

“3 ID (M) received training on GCCS/C2PC one month prior to deploying to the theater. This required enormous training just to get the systems operational and to become familiar with what it provided.”

— Survey Respondent

“For the FBCB2 we had a 4 hour lesson on how to use it, so we did not use it for much more than situational awareness of where units were located.”

— Survey Respondent

“We had only rudimentary training and did not receive this system until just a month or two prior to the war. It was not employed to its fullest.”

— Survey Respondent

“...you've got to understand what you've got; you can't assume what you've got is what you've got...not all icons represent ground truth....You have to understand what you are looking at, and what is underneath the icons to make best advantage of the systems....”

— LTG Wallace, CG, V Corps

*Figure 22. Training and Exercises*

Rehearsing with the information systems will contribute to external and internal coordination by revealing previously unidentified external coordination requirements. Even the manner in which information is presented, especially when using multiple information systems, is important for situational awareness and understanding. Procedures for information sharing and collaboration must be worked out as part of this process.

“FBCB2 was a very successful tool for the SPARTAN brigade because we had the opportunity to train with it during our Brigade LFX in December 2002. This experience allowed us to develop TTPs and understand shortfalls with other systems.”

— Survey Respondent

“We need to be aware that the more fielding of information systems we have means we need more time to train on them, work the bugs out, and integrate them into the big picture.”

— Survey Respondent

“When we got to Kuwait we had the NTC mindset for offensive maneuver that required us to stop and set up our comms and get the commanders together for the issuing of FRAGOs. With the new systems we had, like BFT and TACSAT, we quickly realized that this had to change, that instead of a 10 KM attack we would be attacking over 120 KM at a time and would be dispersed throughout the offensive. Therefore, we had to practice things like issuing FRAGOs over TACSAT instead of face-to-face.”

— MG Blount, CG, 3 ID (M)

*Figure 23. Planning, Exercising, and Rehearsals*

### **Finding 13. Organizing the command post is key to exploiting information.**

The equipment and internal layout of the command post facilities, as well as the formal and informal coordination procedures, should facilitate lateral communications among staff sections and vertical communications between them and the commander. The established procedures can increase organizational competence, for example, by improving a staff's efficiency or by increasing tempo. These procedures can be especially useful in improving the coordination of soldiers who must cooperate to accomplish repetitive tasks, such as the internal functioning of a command post.<sup>67</sup>

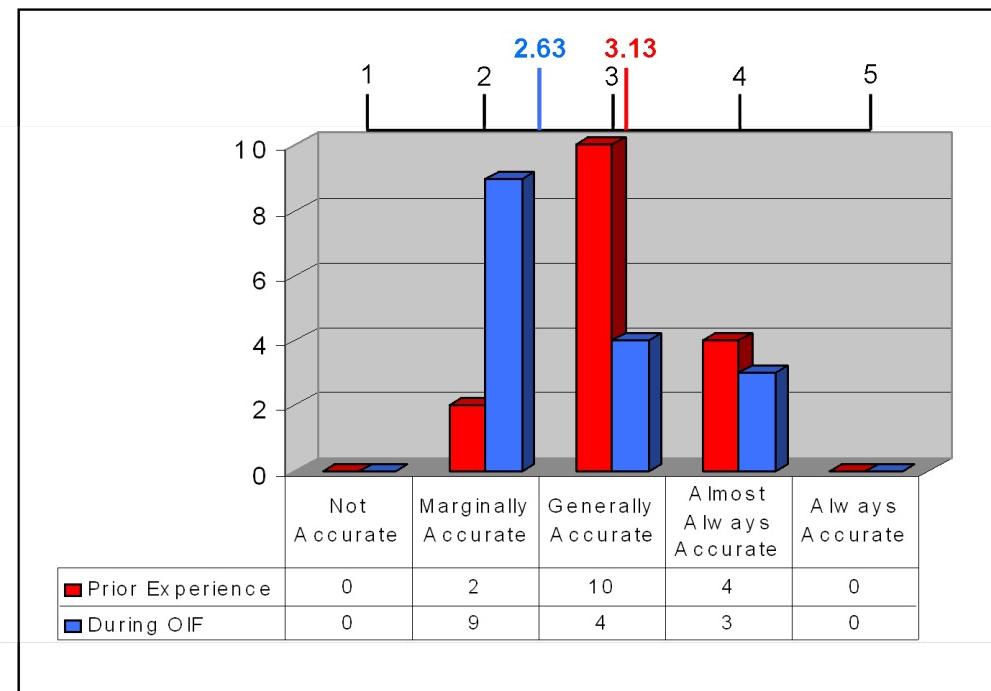
Command post task organizing is key to facilitating information distribution and information sharing. Cohesion and teamwork are important factors in effective information distribution.

An excellent illustration of this finding was the V Corps main command post, which was organized to gain the maximum efficiency for corps shaping operations. This included the collocating of the ACE (Analysis and Control Element), FECC (Fires Effects Coordination Cell), ASOC (Air Support Operations Center), and the SOCOORD. The idea was to build the command post so that intelligence information and fires could be quickly fused. Inside the ACE, analysts were organized so as to enhance their ability to rapidly exchange information and begin cross cueing sensors to

develop targets. Once the targets were developed, the information went to the FECC floor via ADOCS and the targets were assigned for execution.

**Finding 14. The intelligence picture of the enemy was poorer than was expected.**

This study did not directly seek to specifically examine the intelligence BOS, but the subject came up during the senior officer interviews and was frequently mentioned as a survey comment.



*Figure 24. Red Intelligence Picture*

The quantitative input (figure 24) is from General Officers and other senior officer interviews. Based on their prior experiences, these officers felt they had a fairly good picture of the enemy situation, but not as good as they had expected. Exercises like the Battle Command Training Program (BCTP) and those at the National Training Center (NTC) use enemy forces and templating that create high expectations that commanders will have an accurate depiction of red forces. These officers' perception during OIF was of a less accurate picture than their training had led them to expect. Several factors contributed to this perception:

1. This was a different battlefield than what they had rehearsed for. In other words, the enemy rapidly moved to a more nonstandard way of fighting. The original order of battle became irrelevant within the first 24 hours.
2. The forces fighting were more widely dispersed than they had ever experienced, which made the intelligence preparation of the battlefield much more difficult.
3. Much of the enemy was operating out of urban areas, where the collection of intelligence was almost impossible.

The intelligence information carried by the All-Source Analysis System (ASAS) was not working due to connectivity gaps. ASAS relies on the Mobile Subscriber Equipment (MSE) backbone. However, the MSE was not established in the 3 ID (M) at the brigade-level unless the brigade was at the short halt (stable for a period of more than two hours), and the signal was not extended to the battalion subscribers unless the halt was longer than eight hours. ASAS was also difficult to set up. As a result, ASAS was non-operational at the brigade and below for most of the offensive.

Finally, because of the wide dispersion of forces with limited connectivity, there was a reduced ability to pass spot reports past the battalion-level. Therefore, information was not flowing in either direction.

“Fielded Army intelligence systems, such as ASAS, were not effective on the move and limited our ability to pass intelligence products to units forward deployed.”

— Survey Respondent

“Many times we were attacking blind due to lack of intelligence from the Division ACE. We solely had to rely on the JSTARS platform for a majority of our intelligence.”

— Survey Respondent

“There was no information network at the Task Force Level. The commanders and soldiers doing the fighting were executing Movements to Contact, and as I see it, we were information collection systems for our higher HQs.”

— Survey Respondent

“The lack of actionable intelligence had the biggest impact on my decision making. As a result, we had to create courses of action that were risk based.”

— Survey Respondent

*Figure 25. Intelligence Picture*

**Finding 15. The networks, as they exist, are stovepiped by function.**

Stovepiped information systems create artificial barriers to seamless information sharing and make interoperability difficult to achieve. Stovepipes create seams between and among functions and forces, which reduces joint interoperability. These seams create gaps in roles and responsibilities that lead to a lack of accountability for interoperability, information sharing, and collaboration; all of which are necessary for an information age military force.<sup>68</sup>

There are still stovepipes restricting information sharing. Much of this is a result of functional development; e.g., the maneuver control system (MCS) that is part of the Army Battle Command Suite of systems is not joint compatible. There was also evidence that Global Command and Control System-Army (GCCS-A) destabilized the Joint COP and that ASAS did not effectively interoperate with the Marine Expeditionary Force’s intelligence system.<sup>69</sup>

Horizontal integrators of diverse information systems are found only at the division and corps level. Horizontal integrators like ADOCS and JDLM not only allowed for rapid information sharing but also increased the capacity for collaboration. ADOCS was widely praised for increased responsiveness of counterfires and joint fires integration.

“We are wasting taxpayer money if we don’t develop a single integrated system, my paradigm now is the FBCB2, that allows you to call up any BOS.”

— COL Bayer, G-3, 3 ID (M)

“We needed all of the different types of information to enable us to know where to place the collection teams to ensure that they were being covered by other units but not in the way of the fight.”

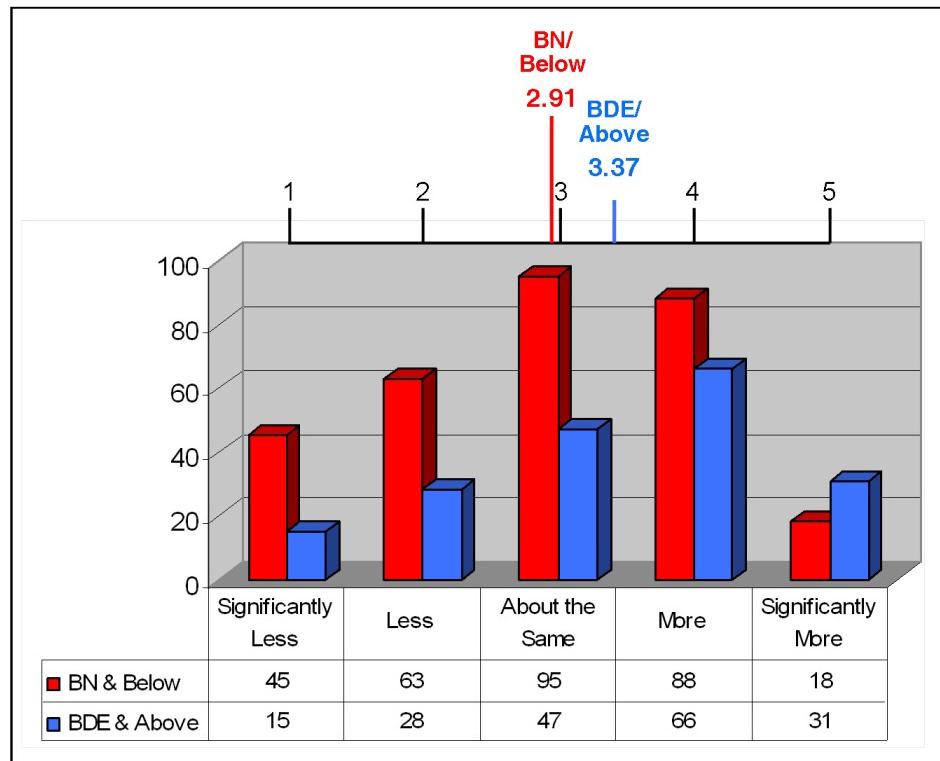
— Survey Respondent

“Since the engineer force supports everyone from the Corps deep strike with topo analysis and FOB/FARP construction to the Corps rear boundary with MSR and LSA construction, I needed information from just about every major unit/BOS on an everyday basis....”

— Survey Respondent

*Figure 26. Stovepipes*

**Finding 16.** There is a connectivity gap below the brigade level; therefore, information is not reaching the lowest levels.



*Figure 27. Connectivity with Others*

"Mission command requires interactive communications characterized by continuous feedback. Feedback provides the means to improve and confirm mutual understandings."<sup>70</sup>

"Accurate situational understanding requires RI [relevant information] from all BOS. Communications is the key for commanders obtaining this relevant information."<sup>71</sup>

When compared to their previous experiences, survey respondents at battalion-level and below, on the whole, indicated that their connectivity during OIF was "about the same," although significantly worse than those above battalion-level. Those at brigade and above had improved connectivity as compared to their previous experiences.

Traditionally, as units maneuver at brigade and below, they are able to maintain connectivity over FM voice nets and the MSE network; both of which are line-of-sight (LOS) communication systems. During OIF, units were much more dispersed, and the LOS systems were not able to fill the connectivity needs. The disparity between units at brigade and above as compared to units at battalion and below reflected in this finding is a direct result of the use of TACSAT communications at brigade and above and the lack of these non-terrestrial communications systems below brigade-level.

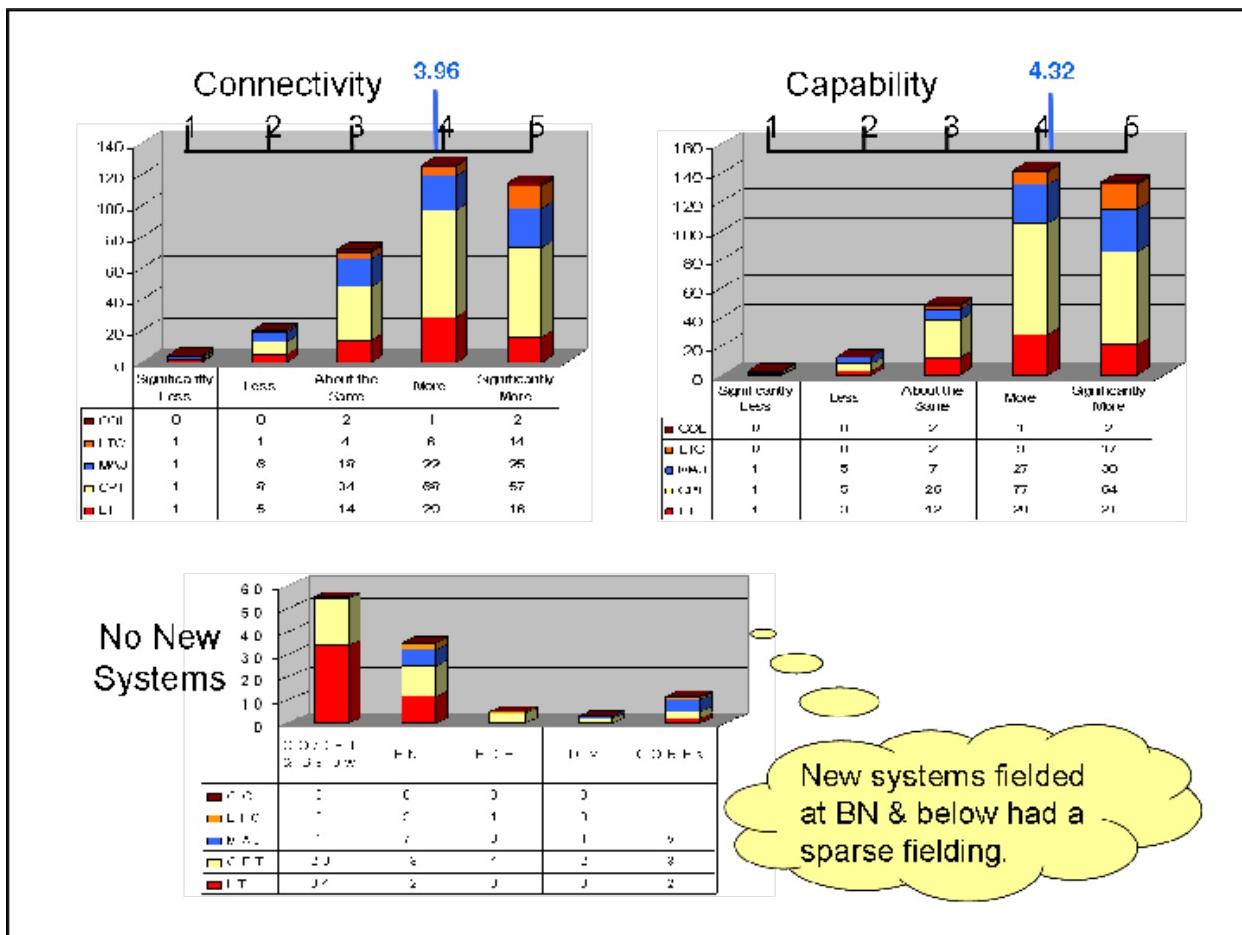


Figure 28. New System Connectivity

This connectivity gap affects the flow of information from and to battalion-level and below. The vast majority of tactical leaders and command posts enjoyed few C2 on-the-move capabilities beyond FM radios. This lack of connectivity affected their ability to effectively and uniformly broadcast situational awareness, transmit changes to orders, and rapidly synchronize mutually supporting missions, branches, and sequels among broadly dispersed subordinate formations that were engaged in fast and furious fighting on a non-contiguous battlefield.

**Finding 17. Bandwidth must be treated as a high demand, low density “class of supply” requiring command attention.**

A recent Congressional Budget Office study drew the following conclusions regarding bandwidth: “First, at all levels of command within the Army, the current demand for bandwidth is larger than the supply—shortfalls of as much as an order of magnitude (or up to 10 times the amount of supply) can exist. Second, shortfalls in the supply of bandwidth will persist at some command levels through and after 2010....Thus, after what is now planned as an investment of \$20 billion in new communications equipment, the Army will fall short of its goals at certain command levels by an order of magnitude.”<sup>72</sup>

An information network must have the ability to transmit or distribute information, which requires connectivity and bandwidth. A failure to provide the connectivity and associated bandwidth will lead to information gaps.

Bandwidth and the connectivity systems with which it is accessed must be acquired. Their use and distribution must be prioritized by commanders. Finally, access to bandwidth must be treated as a high demand, low density commodity that requires command involvement.

#### 5.4 Observations

The following seven observations are based on the assessment team’s insights from this study and are considered worthy of further research.

**Observation 1.** Knowledge, training, experience, and functional perspective are essential elements as to how information is used. Time, space, and competencies vary depending on the level of command. Perception also varies as a factor of the function of the perceiver; the logistian probably will—and probably should—see the battlefield differently and use the available information differently from the tactical or operational commander. This observation has significance for how to design the packaging and delivery of information

**Observation 2.** There is not sufficient information to adequately define and/or qualify “robust” in terms of what constitutes a robustly networked force. In most other studies and in NCW literature, the emphasis in depicting the true gains of NCW occurs where individual entities (e.g., individual aircraft in a flight) readily shared situational awareness. The pushing of the information and connectivity systems to the smallest ground maneuver force has not occurred, and the network at the upper tactical echelons is still immature. Therefore, it is difficult to determine the real implications of a robustly networked force.

**Observation 3.** Situational awareness does not reduce the need for coordination to optimize synchronization.

**Observation 4.** Clearly defined responsibility and authority are still imperatives for decision-making and accountability in the combat environment.

**Observation 5.** NCW neither reduces nor replaces the need for survivable land combat systems and well-led forces. NCW also does not negate the requirement for adequate or competent formations to secure and control terrain and its civil populations once that terrain is “rolled up.”

**Observation 6.** Networking does not replace the need for planning, exercises, or rehearsals. As new systems are introduced, they increase the requirement for planning to integrate them, exercising to achieve their full potential, and rehearsing to ensure synchronization.

**Observation 7.** Information systems increase the need for reliable stable power sources and for greater connectivity (bandwidth).

## 6. DOTMLPF<sup>73</sup>

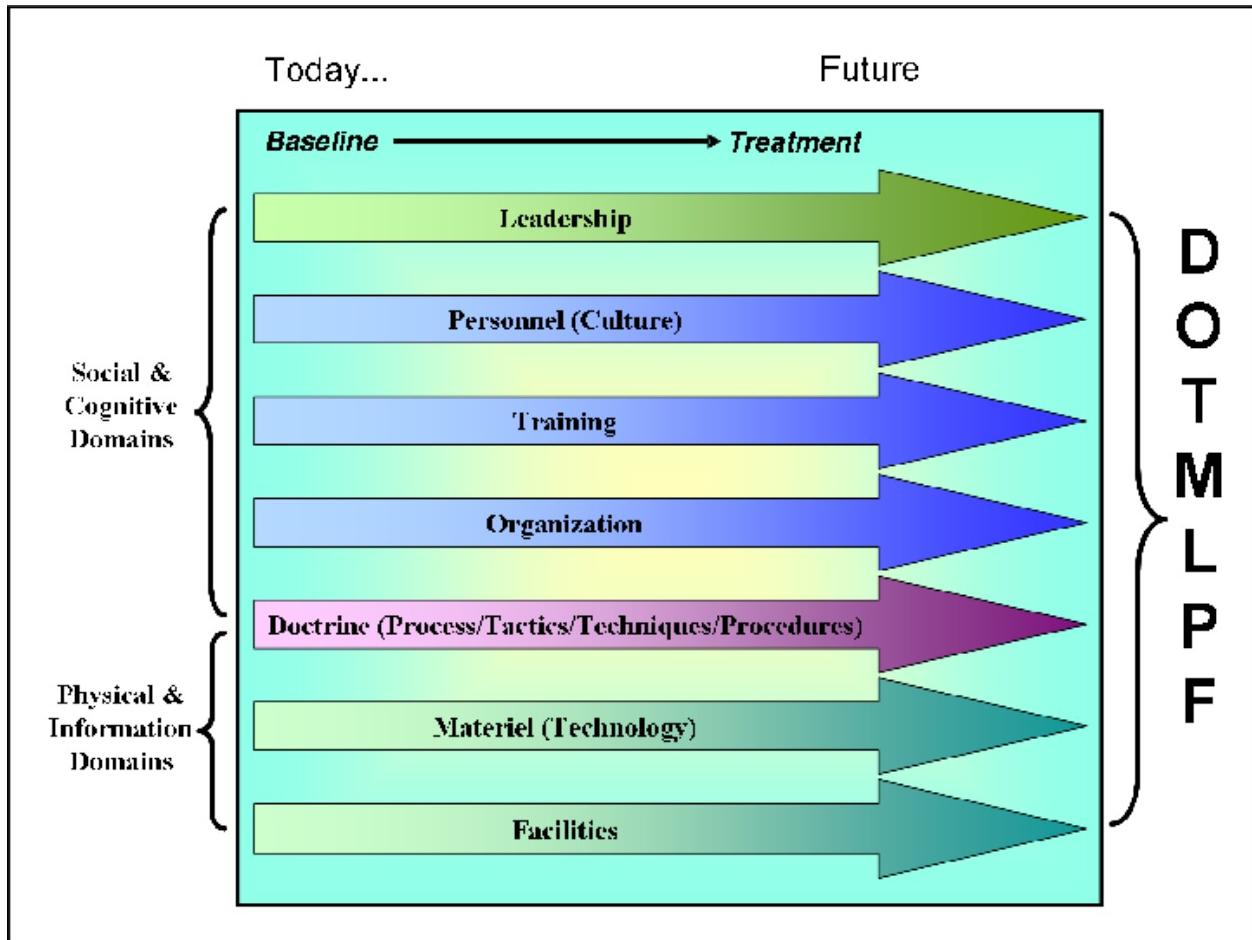


Figure 29. DOTMLPF

If the capabilities of NCW are to be realized, comprehensive change is needed across the DOTMLPF. First, change must occur in the physical and information domains. New communications, weapons, and other supporting infrastructure and information systems must be developed. Information Age technologies developed in the private sector and in conjunction with the military must be rapidly integrated into our force structures. Second, change must occur in the social and cognitive domains. This entails changing the ways people, organizations, and their processes interact. It requires new ways of selecting, training, and educating warfighters, and it depends on the ability to overcome traditional obstacles to information sharing and collaboration. It requires that trust and confidence be fostered amongst a variety of people from diverse backgrounds (functions and services). Breaking down existing stovepipes becomes an imperative within the Army for systems that limit information share-ability between functions. Breaking down barriers that limit collaboration and interoperability between the Army and the other services is equally imperative.

## 6.1 Social and Cognitive Domains

Leader Development.

1. Continue to develop adaptive and innovative leaders who are comfortable with broad mission type orders and working within the commander's intent: a "cavalry" mentality.
2. Develop leaders who are comfortable in the information environment and do not feel the need to micromanage.
3. Require that leaders be familiarized with and operate information systems throughout their career to develop the level of comfort and knowledge required to leverage the most from the available information systems. This requires both institutional (schoolhouse curricula and distributed education self-development programs) and organizational training.
4. Develop leaders who are comfortable operating in a continuous parallel planning process versus the continuous sequential planning process. This requires a type of "benevolent hierarchy" where leaders operating at varying levels of command and staff are freely sharing information and working more in a collegial type environment to accomplish the commander's intent.

Personnel.

1. Officer and enlisted personnel management systems need to recognize and codify the new skill sets. Perhaps now is the time to develop and codify the multi-functional staff officer. Enlisted soldiers working in command posts with information systems should be skill identified and further utilized in that type of assignments.
2. The current arrangement of having information management officers (IMOs) only responsible for information systems and the signal officers only responsible for the connectivity and connectivity systems should be more closely linked.
3. Cultural change may be required to break down information sharing barriers and create an environment that better encourages information sharing. Staffs at all levels must be quicker and more flexible in order to provide an adequate response to the rapid evolution of the commanders' intent based on the speed of operations and the improvement in shared situational awareness. A hierarchical and directive model will not suffice. The goal should be a professional, collegial atmosphere that emphasizes the rapid interchange of information rather than a send-receive-respond method of implementing the commander's intent.

Training. Success on the battlefield is a reflection of tough, realistic training of soldiers and units. The entry price requires familiarity with and confidence in the team itself as well as weapons and/or weapons systems, tactics, techniques, and procedures—all the result of training and exercising. This requirement for training and exercising is the same for preparing units and individuals to exploit all available relevant information in an information rich environment.

Organization.

1. Command posts, especially those at upper echelons, must have a plan to train and integrate augmentees into the organization.
2. The organization of command posts requires flexibility and must support a degree of “ad hoc-ness” to quickly adjust processes and structural design to maximize the sharing of information and increased collaboration in varying situations.

## **6.2 Physical and Information Domains**

Doctrine (Process/Tactics/Techniques/Procedures). Doctrine needs to stress C2 as well as force agility and innovation when adapting to changes in the speed and precision of information and improved knowledge access.

Materiel.

1. Develop and field a collaborative tool for the tactical level.
2. Develop C2 systems that can track entities across the BOS and the joint spectrum.
3. Develop a combination of line-of-sight and over-the-horizon systems providing connectivity down to the lowest tactical level.
4. Develop and field a command and control vehicle (C2V) with on-the-move capabilities down to the battalion level.

Facilities. Develop simulators for schools and organizations to familiarize and train leaders (from junior to senior level) with information systems—a type of “conduct of fire trainer” for information systems.



## 7. RECOMMENDATIONS

The recommendations made concern the utility of the NCO CF and terminology used in explaining NCW concepts.

**Recommendation 1.** The NCO CF was a useful tool in understanding the metrics needed for collecting data as part of this study. However, NCO CF Version 1.0 is difficult to understand and takes several readings to get a better appreciation of what the conceptual framework represents. Recommend using the NCW “new value chain,” as shown in figure 30, which is a more effective representation of NCW concepts.

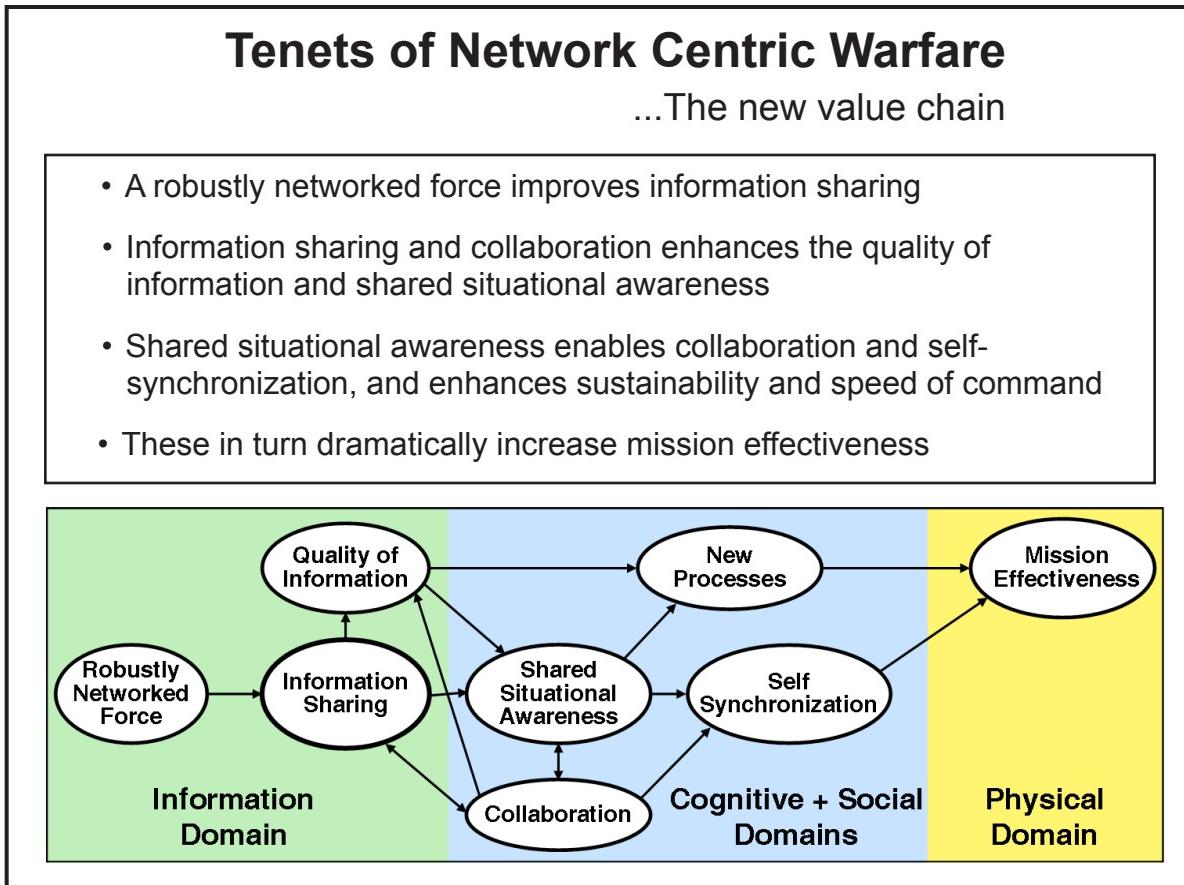


Figure 30. Current NCW Value Chain

**Recommendation 2.** Consider replacing the term “self-synchronization” in the NCW new value chain with “synchronization.” As stated in the NCO CF Version 2, the emphasis has moved to synchronization as an outcome, rather than self-synchronization as a means. This self-synchronization concept may hold promise for commercial enterprise where “*Auftragstaktik*” was never in vogue; however, self-synchronization seems an attempt to replace a widely understood military concept with one designed for commercial enterprise. Perhaps there are some military forces that continue to utilize a highly centralized approach to C2; however, the U.S. Army adopted and has used mission orders for years: Von Moltke’s “*Auftragstaktik*” (mission orders stressing decentralized initiative within an overall strategic design—commander’s intent). This concept

is widely understood and practiced in the Army, perhaps because the ability to impose a highly centralized C2 structure on the lowest tactical forces is severely constrained by bandwidth and by the vast number of small units involved during execution.

**Recommendation 3.** The Army operational tenet of initiative should be added to the new value chain. In this case, initiative has both operational and individual components. From an operational perspective, initiative is setting or dictating the terms of action throughout the battlespace and implies an offensive spirit in all operations. From an individual perspective, initiative is the ability to be a self-starter, to act when there are no clear instructions or when the situation changes. An individual with initiative is willing to decide and initiate independent actions when the concept of operations no longer applies or when an unanticipated opportunity leading to the accomplishment of the commander's intent presents itself. Initiative requires delegating decision-making authority to the lowest practical level.<sup>74</sup> Initiative should be used in lieu of self-synchronization as part of the new value chain, and the tenet should read: "Shared situational awareness enables collaboration and initiative (both individual and operational) enhancing sustainability and speed of command."

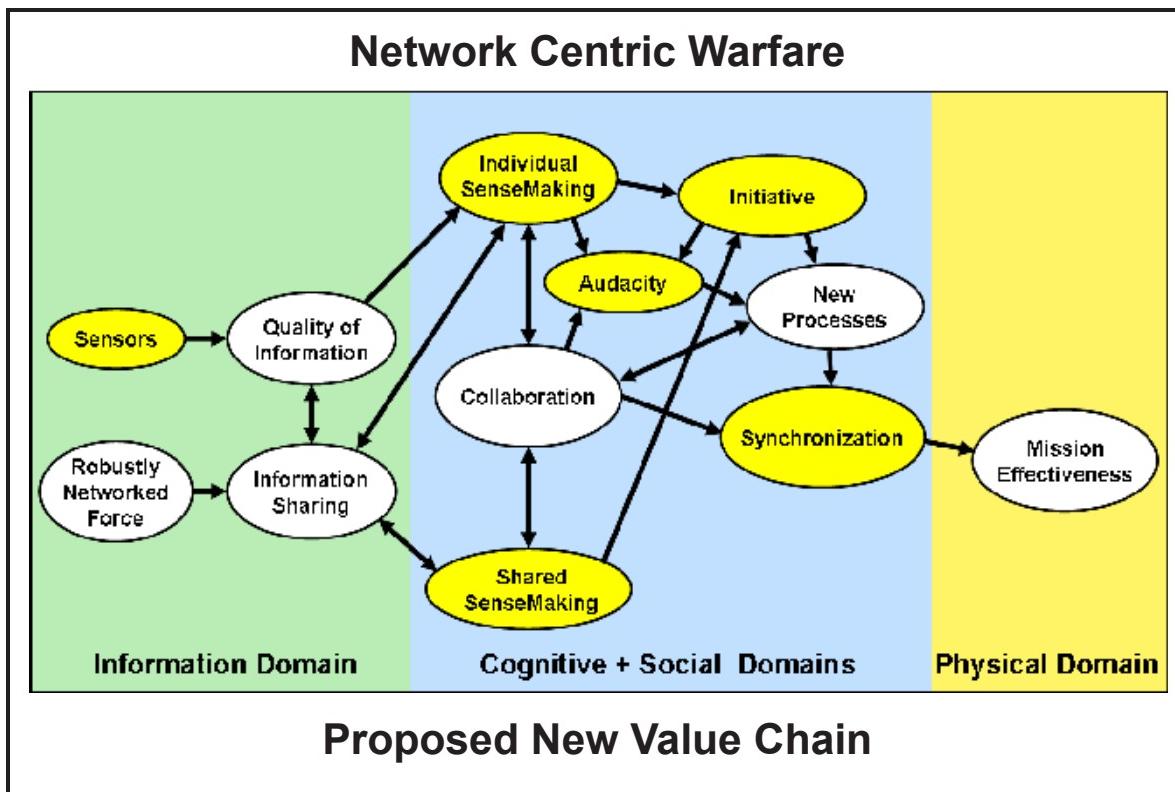


Figure 31. Proposed New Value Chain

**Recommendation 4.** The NCO CF reflects both "individual sensemaking" and "shared sensemaking." However, if the new value chain is to be used as part of the overall NCW presentation, then "individual sensemaking" should be added, as it reflects knowledge, experience, and level/frame of reference—all of which are important to how information is viewed and how situational understanding is achieved. The current "shared situational awareness" should be changed to "shared sensemaking." Awareness only expresses one level of the cognitive hierarchy,

while sensemaking, as shown in the NCO CF, encompasses awareness, understanding, and the decision-making function.

**Recommendation 5.** Include the term audacity as part of the new value chain. To win in spite of numerical inferiority requires that commanders take calculated risks. The ability to calculate the risk, boldly act upon the calculations, and surprise the enemy by action is audacity.

**Recommendation 6.** It is time to think about changing the name of NCW to “Net-enabled, Commander-Centric Warfare,” as the concept really is about networking the warfighting enterprise, where the enterprise consists of commanders, enablers (shooters and other effectors), and sensors. The use of the term network-centric insinuates that it is the network that is central to the successful prosecution of the warfare: a view that warfare is more science than art. However, the term net-enabled implies that the net is enabling the synchronization of warfare, which is the realm of the commander and thus, commander-centric: a view that warfare is more art than science. In fact, this study has shown that it is the effective use of information by individual commanders and the effective interactions of those commanders that enabled the successful prosecution of the war.



## 8. CONCLUSIONS

### 8.1 NCW Tenets to Findings

The following links the NCW tenets to the case study findings.

**Tenet 1.** A networked force improves information sharing. The specific findings that support this tenet are findings 2 and 11. Findings 15, 16, and 17 are impediments to a fully effective network where information is not being shared because of stovepipes, connectivity gaps, and bandwidth limitations.

**Tenet 2.** Information sharing and collaboration enhance the quality of information and shared situational awareness. The specific findings that support this tenet are findings 4, 5, 6, 7, 8, 9, 12, 13, and 14.

**Tenet 3.** Shared situational awareness enables collaboration and self-synchronization, and enhances sustainability and speed of command. The specific findings that support this tenet are findings 3, 4, and 10.

**Tenet 4.** Increased mission effectiveness. The specific findings that support this tenet are findings 1, 2, 4, and 9.

### 8.2 Impacts of the Information Environment

The way that U.S. V Corps and 3<sup>rd</sup> Infantry Division (Mechanized) conducted offensive operations during the March–April 2003 against Iraqi forces was unique. Much of this is directly attributable to the introduction of new tactical sensors (LRAS3 and Hunter UAV), extended connectivity (TACSAT 25 kHz and other systems), and networked information systems. The impacts of these new systems were profound.

The corps and division used new tactical sensors to locate enemy targets and increase the precision of fires. The LRAS3 and the Hunter UAV were enablers that changed the way units operated. These enablers contributed by

- 1. Improving the quality of organic information.** The LRAS3 was not networked and required voice spot reports to share the information. The Hunter UAV feeds provided shared information to those who had access to the images provided by the ground control station. Each system improved the day and night target acquisition capabilities of the force. The ten digit grid coordinates provided by the LRAS3 enabled precise artillery fires and significantly reduced the ammunition expenditure needed to achieve desired effects. The Hunter UAV feed required mensuration (the conversion process between pixels and real world measurements) to attain the precise coordinates required for indirect fires; however, the feed provided immediately available information for the use of CAS.

2. **Improving the quality of both individual and shared sensemaking.** The high quality of information derived from these sensors improved awareness and understanding, leading to rapid decisions. Corps' shaping operations were reliant on the information provided by the Hunter UAV.
3. **Improving the degree of effectiveness and agility.** These new sensors improved the time and accuracy to acquire targets and increased the efficiency and effects of fires placed against those targets. The result was increased freedom of maneuver and greater overall force agility.

The corps and division fought at a higher operational tempo and more widely dispersed than previously possible. Breaking the bonds of line-of-sight communications was the key, and the single-channel wide-band TACSAT and the L-band BFT transceiver were the connectivity enablers. These enablers contributed by

1. **Improving the quality of the network.** TACSAT and the BFT L-band transceiver significantly improved the reach for the forces that had these systems (the TACSAT was at brigade and above; the BFT was primarily found at the maneuver company level and above).
2. **Improving the degree of information share-ability.** BFT was most responsible for the improved share-ability, since it automatically posted information and widely distributed the information to all others within the BFT network.
3. **Improving the degree of individual information.** These two systems provided the basis from which commanders and others gained situational awareness and understanding. Because of the L-band transceiver, the BFT was able to distribute data accurately; this data, when combined with all of the other BFT data transmissions, formed the COP. This COP formed the basis for individual situational awareness in relation to the rest of the fighting force. It was through the TACSAT broadcast communications between commanders and with others, when required, that the basis for situational understanding was established.
4. **Improving the quality of both individual and shared sensemaking.** The COP presented by the BFT, combined with the voice broadcasts of relevant information over TACSAT, allowed commanders and all others with access to this information to rapidly attain individual understanding. This high level of distribution and interaction provided for a high degree of shared sensemaking. This level of understanding resulted in shortened decision cycles for commanders.
5. **Improving the quality of interactions.** Even though the limited fielding of these systems restricted the number of individuals able to interact, the depth of the interactions that occurred via the voice broadcasts on TACSAT and via e-mail and graphics exchanges over BFT was of the highest order and was essential to mission success. A resultant effect of these exchanges was increased risk tolerance.
6. **Improving the degree of shared information.** There were approximately 1,200 BFT systems fielded throughout the entire theater of operations, and these were distributed across the

ground forces (U.S. and coalition) to enable a blue force COP. The COP was not complete, as the extent of the fielding was limited primarily to maneuver forces only and then only two per company. However, even this limited BFT fielding provided a COP that was accurate, relevant, and timely beyond any previous experiences. TACSAT also provided the capability to share relevant information rapidly and allowed commanders to accurately describe the more complete picture and the significance of events.

7. **Improving the degree of decisions, plans, and actions that were synchronized.** The extended connectivity enabled greater information sharing and collaboration between commanders, commanders and their staffs, and staff to staff. This collaboration resulted in execution decisions that were supported by plans that resulted in synchronized execution by varied units across the dispersed battlespace.
8. **Improving the degree of C2 and force agility.** The extended connectivity enabled battle command on the move, better synchronization of the battlespace, shorter decision cycles with greater confidence in decisions, and the capacity to fight widely dispersed separate engagements simultaneously. The extended connectivity allowed V Corps and 3<sup>rd</sup> Infantry Division to achieve new levels of agility. Without the extended connectivity the operational tempo of the offensive would have been greatly reduced and the offensive would have been fought in much closer, traditional formations, as the units would have been tied to legacy Mobile Subscriber Equipment (MSE) communications and its limitations.

The corps and the division fought with a higher degree of shared situational awareness, increased collaboration, audacity, and synchronization than at any time in the past. Information systems like the FBCB2, ADOCS, C2PC, and MTS are examples of the enablers that provided unprecedented levels of situational awareness and provided the means for greater collaboration, resulting in greater audacity on the part of the commanders and a high degree of battlespace synchronization. Information system enablers contributed by:

1. **Improving the degree of information share-ability.** The information systems allowed wide dissemination of information, for example, the COP. Information systems, like ADOCS, that fused information from multiple information systems made this integrated information readily available for rapid collaboration and decision making.
2. **Improving the quality of individual and shared sensemaking.** The information systems provided information that was consistently accurate, timely (near-real-time, a latency of five minutes on the blue force COP), and relevant. Situational awareness was quickly achieved by those who had access to the information systems.
3. **Improving the quality of interactions.** The “pictures” that were provided by the various information systems created a common basis for interactions. They allowed interactions to begin at a higher level of situational awareness. The interactions led to increased collaboration, as in the fires approval process using ADOCS. Interactions also led to rapid individual and shared understanding that resulted in faster decision-making with a higher confidence in the decisions.

4. **Improving the degree of decisions, plans, and actions that were synchronized.** The information enablers allowed commanders, commanders and their staffs, and staff to staff coordination and collaboration to achieve new levels of synchronization in supporting execution-based decision making.
5. **Improving the degree of C2 and force agility.** The information enablers allowed for more responsive fires across the battlespace, for increased flexibility and responsiveness in the maneuver formations, and for a high degree of battlespace synchronization.

### 8.3 Implications for the Future

There is reason to believe that the results of this study may underestimate the potential of a robustly networked force and its capacity for conducting future land warfare. We must continue to fill the connectivity and information gaps in the land force and allow information to flow to and from the lowest tactical forces in order to realize this potential in the future. However, unless the nature of land warfare changes significantly, land forces will always become responsible for the land and its inhabitants once enemy forces are dominated in the area and the terrain is “rolled up.” This requires sufficient ground forces for securing the lines of communications, tending to civil affairs and medical needs, securing and protecting enemy prisoners of war, and a multitude of other tasks. The enhanced information environment of a robustly networked force will increase the efficiency and synchronization of these tasks, but it will not eliminate them. Further, the robustly networked force will not eliminate the need for highly survivable and lethal ground combat systems. The enemies of the future will continue to adapt and continually move to more asymmetrical means of fighting U.S. forces. They will develop asymmetrical approaches to reduce the capabilities and efficiencies provided by the enhanced information environment. These asymmetrical approaches may include more urban fighting, network attacks, electronic warfare, guerilla/insurgent warfare, terrorism, and combinations of asymmetrical approaches.

## *Notes*

1. Evidence Based Research, Inc., *Network Centric Operations Conceptual Framework, Version 1.0*, report prepared for the Office of the Secretary of Defense, Office of Force Transformation (Vienna, VA: Evidence Based Research, 2003), 3.
2. John Garstka and David S. Alberts, *Network Centric Operations Conceptual Framework, Version 2.0*, report prepared for the Office of the Secretary of Defense, Office of Force Transformation (Vienna, VA: Evidence Based Research, 2004), iv.
3. Office of the Secretary of Defense, Office of Force Transformation, *Network Centric Warfare: Department of Defense Report to Congress*, (Washington, D.C., 2001), i.
4. Ibid.
5. David S. Alberts, John Garstka, et al., *Network Centric Warfare: Developing and Leveraging Information Superiority* (Washington, D.C.: National Defense University Press, 1999), 2.
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8. OSD, OFT, *Report to Congress*, i.
9. *Conceptual Framework*, Ver. 1. sec. 5.0.
10. OSD, OFT, *Congress*, 36.
11. *Conceptual Framework*, Ver. 1. 5.
12. Ibid.
13. Carl von Clausewitz, Michael Eliot Howard, and Peter Paret, *On War*, (Princeton, N.J.: Princeton University Press, 1984), 102.
14. William F. Donaher and Ross B. DeBlois, “Is the Current UN and US Policy toward Iraq Effective?” *Parameters*, XXXI (No. 4): 112-125.
15. U.S. European Command, headquartered in Heidelberg, Germany, with responsibility for Europe and most of Africa.
16. U.S. Central Command, headquartered in Tampa, Florida, with responsibility for most of the Middle East and Central Asia. USCENTCOM was in command of OIF.
17. All of the commanders and staff officers interviewed spoke of the quality and intensity of training that their soldiers and organizations went through as they prepared for combat. See note 19.
18. United States Army, 3rd Infantry Division, (Mechanized), *OPERATION IRAQI FREEDOM: Third Infantry Division (Mechanized) “Rock of the Marne” After Action Report*, Final Draft, (12 May, 2003), chap. 1 (topic A).
19. Stephen D. Biddle, James Embry, et al., *Toppling Saddam: Iraq and American Military*

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*Transformation* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, 2004), *passim*. During the interview with LTG Wallace (see note 29), General Wallace described the Iraqi military command and control as largely dysfunctional. Biddle and his group pointed out the general ineptitude of the Iraqi military and paramilitary forces.

20. David S. Alberts, J. John Garstka, et al., *Understanding Information Age Warfare*, CCRP Publication Series (Washington, D.C., 2001), 123.
21. Department of the Army, Headquarters, FM 6-0, *Command and Control of Army Forces* (Washington, D.C., 2003), para. 2-63.
22. Department of the Army, Headquarters, FM 3-0, *Operations* (Washington, D.C., 20013), para. 11-43.
23. *FM 6-0*, B-1.
24. Alberts, Garstka, et al., *Network Centric Warfare*, 19.
25. *FM 3-0*, para. 4-3.
26. Ibid.
27. *FM 6-0*, para. 4-94.
28. Department of the Army, Headquarters, FM 100-15, *Corps Operations* (Washington, D.C., 1996), 4-6.
29. Ibid., 4-12
30. Ibid., 4-6
31. Interviews with LTG William Scott Wallace at Ft. Leavenworth, KS, 28 April, 2004, and MG Buford Blount at the Pentagon (see note 32) by J.B.I. Tisserand and D.E. Williams. These were network centric case study interviews of LTG Wallace and MG Blount based on their experiences during the period of major combat operations, Mar-May 2003, Operation Iraqi Freedom.
32. 3<sup>rd</sup> ID (M). *OPERATION IRAQI FREEDOM*, “Executive Summary,” para. a.
33. Ibid., 125.
34. Maj. Gen. Buford Blount, interview by J.B.I. Tisserand, and D. E. Williams, the Pentagon, Washington, D.C. 19 August, 2004. This was a network centric case study interview of MG Blount on his experiences during the period of major combat operations, Mar-May 2003, Operation Iraqi Freedom.
35. Anthony H. Cordesman, “The ‘Instant Lessons’ of the Iraq War: Main Report” (8th Working Draft, Center for Strategic and International Studies, Washington, D.C., 14 May 2003), 205.
36. *FM 6-0*, para. 2-20.
37. *FM 3-0*, para. 1-56.
38. Alberts, Garstka, et al, *Network Centric Warfare*, 19.

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39. Gregory Fontenot, E.J. Degen, et al., *On Point: The United States Army in Operation Iraqi Freedom* (Fort Leavenworth, KS: Combat Studies Institute Press) 2004), 391.
40. Elihu Zimet, Robert E. Armstrong, et al., "Technology, Transformation, and New Operational Concepts." *Defense Horizons*, 31 (2003): 8.
41. Alberts, Garstka, et al, *Network Centric Warfare*, 159.
42. Ibid., 158.
43. 3<sup>rd</sup> ID (M). *OPERATION IRAQI FREEDOM*, "Executive Summary," chap. 4.
44. Charles E. Kirkpatrick, *Joint Fires as They Were Meant to Be: V Corps and the 4th Air Support Operations Group During Operation IRAQI FREEDOM* (Washington, D.C., The Institute of Land Warfare, 2004), 1.
45. Ibid., 18.
46. 3<sup>rd</sup> ID (M). *OPERATION IRAQI FREEDOM*, chap. 4 (topic A).
47. Ibid.
48. *FM 3-0*, para. 4-77.
49. Alberts, Garstka, et al., *Network Centric Warfare*, 135.
50. Borg, STARTREK.COM, Episode TNG 142.
51. 3<sup>rd</sup> ID (M). *OPERATION IRAQI FREEDOM*, chap. 1.
52. Headquarters, United States Army, *TRADOC PAM 525-70, Battlefield Visualization Concept* (Washington, D.C., 1995), 1-3.
53. Ibid., para. 3-1c.
54. Ibid., para. 3-2a(3).
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56. Ibid.
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58. *FM 6-0*, para. 5-52.
59. Ibid., para. 2-93.
60. Ibid., para. 2-96.
61. Ibid., para. 6-23.
62. *FM 3-0*, para. 4-27.
63. Alberts, Garstka, et al., *Network Centric Warfare*, 106.
64. David S. Alberts, John Garstka, et al., *Understanding Information Age Warfare*, CCRP Publication Series (Washington, D.C., 2001), 96.

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65. Cordesman, "Instant Lessons," *passim*.
66. *FM 6-0*, para. 1-89.
67. *Ibid.*, para. 5-74
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70. *FM 6-0*, para. 3-74.
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72. Congress of the United States, Congressional Budget Office, *The Army's Bandwidth Bottleneck* (Washington, D.C., 2003), x.
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Interview with Lieutenant Colonel Craig Finley, Commander, 1st Battalion, 39th Field Artillery Regiment (MLRS), 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 5 May 2004.

Interview with Lieutenant Colonel William T. Gillespie, Jr., Division Material Management Officer, Division Support Command, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 6 May 2004.

Interview with Lieutenant Colonel Mike Johnson, Executive Officer, Task Force 3-69 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 17 March 2004.

Interview with Lieutenant Colonel Stephen R. Lyons, Commander, 703rd Main Support Battalion, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 7 May 2004.

Interview with Lieutenant Colonel Ernest Marcone, Commander, Task Force 3-69 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 16 Mar 2004.

Interview with Lieutenant Colonel Mike McGee, Deputy Commander, 4th Air Support Operations Group (ASOG), Supporting V Corps, during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 17 May 2004.

Interview with Lieutenant Colonel John Mowers, Assistant Chief of Staff, Intelligence (G-2), 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 4 May 2004.

Interview with Lieutenant Colonel Wade Parks, Chief Information Management Officer, Coalition Land Component Command, during Operation Iraqi Freedom, Mar-May

## Network Centric Warfare Case Study

2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 18 March 2004.

Interview with Lieutenant Colonel Mike Presnell, Commander, 10th Engineer Battalion, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 5 May 2004.

Interview with Major Kenneth W. Benigno, Battalion Operations Staff Officer (S-3), and Captain Richard A. Dunbar, Commander, a Battery, 1st Battalion, 39th Field Artillery (MLRS), 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 7 May 2004.

Interview with Major Mike Donovan, Task Force Operations Staff Officer (S-3), Task Force 1-64 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 5 May 2004.

Interview with Major Garth Horne, Battalion Operations Staff Officer (S-3), 11th Engineer Battalion, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 17 March 2004.

Interview with Major Benjamin Matthews, Brigade Fire Support Officer, 1st Brigade Combat Team, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Lieutenant Colonel Alan Seise and Major Douglas R. Lindsay (USAF). Video taped interview, 20 July 2004.

Interview with Major Ricky J. Nussio, Executive Officer, Task Force 1-64 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 4 May 2004.

Interview with Major Mike Oliver, Task Force Operations Staff Officer (S-3), Task Force 3-69 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 16 March 2004.

Interview with Major Philip Rice, Battalion Operations Staff Officer (S-3), 1st Battalion, 9th Field Artillery Regiment, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 4 May 2004.

Interview with Major Thomas C. Thompson, Special Operations Coordinator, V Corps, during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand

## Network Centric Warfare Case Study

III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 20 September 2004.

Interview with Captain Todd Kelly, Commander, Company C, 2-7 Infantry, Task Force 3-69 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 16 March 2004.

Interview with Captain Jared Robbins, Commander, C Company, Task Force 3-69 Armor, 3rd Infantry Division (Mechanized), during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by Ian McDougall from Pa Consulting, Greg Boehmer from Pa Consulting, John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 16 March 2004.

Interview with Staff Sergeant Erik A. Kountz, NCOIC, Corps Tactical Operations Center C4I Networks, V Corps, during Operation Iraqi Freedom, Mar-May 2003. Interview conducted by John B. Tisserand III, Colonel, U.S. Army, Retired and Duane E. Williams, Colonel, U.S. Army, Retired. Video taped interview, 19 May 2004.



## Appendix A

### *Peer Reviewers*

The peer review process involved a series of reviews by three independent peer reviewers. This was planned and incorporated into the study from the outset. The peer reviewers used for this study were General William S. Wallace for his command and operational expertise (he held the rank of Lieutenant General and was the V Corps Commanding General during the focused timeframe of this study), MG (Retired) Robert Scales for his historical expertise, and Mr. E.B. Vandiver from the Center for Army Analysis for his analytical expertise.

The peer review process ensured that the findings for the study were relevant and were supportable by the data collected. The insights and comments provided by the peer reviewers were invaluable.

**General William S. Wallace**  
**Commanding General, United States Army Training and Doctrine Command**  
**Fort Monroe, VA**

General Wallace assumed the duties of Commander, United States Army Training and Doctrine Command on October 13, 2005, after serving as the Commanding General, United States Army Combined Arms Center and Fort Leavenworth.

General Wallace was commissioned through the United States Military Academy in 1969. He has a Master of Science degree in Operations Analysis and Master of Arts degrees in International Relations and National Security Affairs.

As TRADOC Commander, General Wallace is responsible for recruiting, training, and educating the Army's Soldiers; developing its leaders; supporting training in units; developing doctrine; establishing standards; and building the future Army. TRADOC is comprised of over 50,000 Soldiers and Department of the Army civilians operating in 33 Army schools across sixteen installations.



General Wallace has commanded with distinction at every possible level from platoon to corps and on two separate occasions led Soldiers in combat. In 1972, he served as an assistant district advisor and later as an operations advisor in the Bac Lieu Province, Vietnam. As the V Corps Commander, General Wallace led the Army's attack to Baghdad in Operation Iraqi Freedom. General Wallace's first assignment was as a platoon leader and troop executive officer in the 2nd Squadron, 6th Armored Cavalry Regiment at Fort Meade. After returning from his first combat tour, he commanded a company at Fort Bragg in the 4th Battalion (Light) (Airborne), 68th Armored Regiment with the 82nd Airborne Division. During the first of three tours to Germany, he took command of 3rd Squadron, 2nd Armored Cavalry Regiment in 1986. Following an assignment as the Senior Armored Task Force Trainer and chief of staff at the Army's National Training Center (NTC) at Fort Irwin, General Wallace returned to Germany in 1992 becoming the 55th Colonel of the 11th Armored Cavalry Regiment in Fulda. After Regimental command, he returned to Fort Irwin, where he commanded the NTC's operation group and later became commander of the NTC. In 1997, General Wallace took command of the 4th Infantry Division (Mechanized) at Fort Hood. Following division command, he served as Commander, Joint Warfighting Center, and as the Director, Joint Training J-7, in the U.S. Joint Forces Command, Suffolk, Virginia. Returning to Germany for his third tour, General Wallace assumed command of V Corps in 2001.

General Wallace attended both the Armor Officer Basic and Advanced Courses; the Naval Post-graduate School in Monterey; the Army Command and General Staff College at Fort Leavenworth; and the United States Naval War College in Newport. Among his awards and decorations are the Defense Distinguished Service Medal, the Distinguished Service Medal with oak leaf cluster, the Legion of Merit with four oak leaf clusters, the Bronze Star Medal, the Meritorious Service Medal with oak leaf cluster, the Army Commendation Medal with "V" device, the Army Commendation Medal with two oak leaf clusters, the Army Achievement Medal, the Vietnamese Cross of Gallantry, the Combat Infantryman's Badge, the Parachutist Badge, and the Ranger Tab.

**Major General Robert H. Scales, Jr., United States Army (Retired)**

MG Robert H. Scales, Jr., USA (Retired) is currently the President of COLGEN, LLC, the former President and CEO of Walden University, and President of Capstar Government Services (CGS). He is an independent consultant for defense matters. Prior to joining the private sector, Dr. Scales served over thirty years in the Army, retiring as a Major General. He commanded two units in Vietnam, winning the Silver Star for action during the battles around Dong Ap Bia (Hamburger Hill) during the summer of 1969.

Subsequently, he served in command and staff positions in the United States, Germany, and Korea, and ended his military career as Commandant of the United States Army War College. In 1995 he created the Army After Next program, which was the Army's first attempt to build a strategic game and operational concept for future land warfare. He is the author of *Certain Victory*, the official account of the Army in the Gulf War, and *Firepower in Limited War*, a history of the evolution of firepower doctrine since the end of the Korean War. He was the only serving officer to have written books subsequently selected for inclusion in the official reading lists of two services; Certain Victory for the Army and Firepower for the Marine Corps. In addition he has written *Future Warfare*, a strategic anthology on America's wars to come, and *Yellow Smoke: The Future of Land Warfare for America's Military*. His latest work, *The Iraq War: A Military History*, written with Williamson Murray was published by Harvard University Press in October 2003. He is military analyst for National Public Radio and Fox News Network and is a frequent commentator and consultant for other major media networks on issues relating to military history and defense policy. He is a graduate of West Point and earned his PhD in history from Duke University.



**Mr. Edgar B. Vandiver III**  
**Director, Center for Army Analysis**

Mr. Edgar Bishop Vandiver III became the Director of the Center for Army Analysis in 1984. Mr. Vandiver graduated from the University of Missouri at Columbia in 1960 with a degree in Physics. He also holds a Masters of Science Degree in Physics from the University of Missouri. Mr. Vandiver has pursued studies in military history, Russian history, and computer science. He is a graduate of the Federal Executive Institute Senior Executive Education program and the Harvard University Program for Senior Executives in National and International Security.

Upon graduation from the University of Missouri in 1960, he was commissioned through the ROTC program a second lieutenant in the U.S Army. As a US Army Chemical Corps Lieutenant assigned to the Chemical, Biological Radiological Combat Developments Agency from March 1962 until August 1964, he conducted studies of nuclear fallout and directed a series of large-scale experiments on the efficacy of chemical defensive equipment items under field conditions and thereafter extended the results by simulation.



Upon leaving active duty, Mr. Vandiver became an Operations Research Analyst for the Combat Operations Research Group (CORG), Technical Operations, Inc., at Fort Belvoir, Virginia. CORG was one of the pioneering organizations in the history of OR in the United States Army. At CORG he participated in war games of the air mobility division and of chemical and biological operations, served in Vietnam on the Army Combat Operations in Vietnam (ARCOV) Study and conducted a major study of artillery ammunition requirements for combat operations in Vietnam. In 1967 he and several other practicing analysts founded a small research business, CVA Inc., in Alexandria, Virginia.

Mr. Vandiver returned to federal service in 1970 working for Mr. Abraham Golub as the Chief, Planning Division, Scientific Advisor's Office, Office of the Assistant Chief of Staff for Force Development, HQDA, Pentagon. In 1974, he became a Research Analyst for Systems, Office of the Deputy Under Secretary of the Army (Operations Research). Mr. Vandiver worked on numerous projects for the first DUSA (OR), Dr. Wilbur B. Payne, and later for Mr. David C. Hardison, his successor. In 1977, Mr. Vandiver became Technical Advisor to the Deputy Chief of Staff for Operations and Plans (DCSOPS) where he was the functional proponent for the Military Officer Operations Research/Systems Analysis specialty, managed a significant part of the Army study program, and as one of the senior analysts on the Department of the Army Staff, provided guidance and oversight to a myriad of high level analytical efforts and studies.

In 1984 Mr. Vandiver became the second Director of the U.S. Army Concepts Analysis Agency (CAA) in Bethesda, Maryland. This agency was renamed the Center for Army Analysis (CAA) in 1998 and moved to Wilbur B. Payne Hall, Fort Belvoir, VA in 1999. As the Director of CAA he has supported the highest levels of Army decisionmaking and has sponsored internal research

and analytical model development programs. He has encouraged and provided education and mentorship to numerous junior and mid-career operations research analysts, and has advanced the science of OR through practitioner studies and military wargaming.

Mr. Vandiver has been awarded the Presidential Ranks of Distinguished and Meritorious Executive, the Department of Defense Distinguished Civilian Service Award, the Department of the Army Exceptional Civilian Service Award, the Distinguished Executive Service Award of the Senior Executives Association, and The Order of National Security Merit of the Republic of Korea. He is a Fellow of the Military Operations Research Society and has been honored with their highest award, the Wanner Medal.

Mr. Vandiver is married to the former Patricia Finley of Southfield, Michigan; they have three children.



## Appendix B

### *Personal Interviews*

GEN Barry McCaffrey	Commanding General, 24 <sup>th</sup> Infantry Division (Mechanized), Operation DESERT STORM
LTG William S Wallace	Commanding General, V Corps, Operation IRAQI FREEDOM (OIF)
MG Buford Blount	Commanding General, 3 <sup>rd</sup> Infantry Division (Mechanized) (3 ID (M)), OIF
MG Walter Wojdakowski	Deputy Commanding General, V Corps, OIF
BG Charles Fletcher Jr.	Commanding General, 3 <sup>rd</sup> COSCOM, OIF
BG Daniel Hahn	Chief of Staff, V Corps, OIF
COL Daniel Allyn	Commander, 3 <sup>rd</sup> Brigade, 3 ID (M), OIF
COL Steven Boltz	G-2, V Corps, OIF
COL David Brown	Deputy G-3 (Chief of Operations), V Corps, OIF
COL Fred Carter	G-4, V Corps, OIF
COL John Paul Gardner	Commander, 7 <sup>th</sup> Corps Support Group, V Corps, OIF
COL William Grimsley	Commander, 1 <sup>st</sup> Brigade, 3 ID (M), OIF
COL Steve Hicks	G-3, V Corps, OIF
COL Theodore Janosko	Commander, V Corps Artillery, V Corps, OIF
COL Thomas Kruegler	Deputy G-3, V Corps, OIF
COL Gregg Martin	Commander, 130 <sup>th</sup> Engineer Brigade, V Corps, OIF
COL Jeffrey G. Smith Jr.	Commander 22 <sup>nd</sup> Signal Brigade, and G-6, V Corps, OIF
COL John E. Sterling	Chief of Staff, 3 ID (M), OIF
COL Thomas Torrance	Commander, Division Artillery, 3 ID (M), OIF
COL William Wolfe	Commander, 11 <sup>th</sup> Attack Helicopter Regiment, V Corps, OIF

LTC Peter Bayer	G-3, 3 ID (M), OIF
LTC Joseph Brendler	Commander, 123 <sup>rd</sup> Signal Battalion, and G-6, 3 ID (M), OIF
LTC Scott Brown	S-3, 4 <sup>th</sup> Brigade (Aviation Brigade), 3 ID (M), OIF
LTC Laurie Buckhout	Commander, 32 <sup>nd</sup> Signal Battalion, 22 <sup>nd</sup> Signal Brigade, V Corps, OIF
LTC John Charlton	Commander, Task Force (TF) 1-15 Infantry, 3 ID (M), OIF
LTC Trent R. Cuthbert	Deputy Fire Support Coordinator, V Corps, OIF
LTC Terry Ferrell	Commander, 3-7 Cavalry, 3 ID (M), OIF
LTC Craig Finley	Commander, 1-39 Field Artillery (MLRS), 3 ID (M), OIF
LTC Willaim T. Gillespie	Division Material Management Officer, Division Support Command (DISCOM), 3 ID (M), OIF
LTC Stephen R. Lyons	Commander, 703 <sup>rd</sup> Main Support Battalion, 3 ID (M), OIF
LtCol Michael McGee	Air Liaison Officer, V Corps, OIF
LTC Ernest Marcone	Commander, TF 3-69 Armor, 3 ID (M)
LTC John Mowery	G-2, 3 ID (M), OIF
LTC Wade Parks	Chief of Information Management, Combined Forces Land Component Command, OIF
LTC Michael Presnell	Commander, 10 <sup>th</sup> Engineer Battalion, 3 ID (M), OIF
LTC Kevin Thompson	Assistant Fire Support Coordinator, V Corps, OIF
MAJ Benigno	S-3, 1-39 Field Artillery (MLRS), 3 ID (M), OIF
MAJ Mike Donovan	S-3, TF 1-64 Armor, 3 ID (M), OIF
MAJ Garth Horne	S-3, 11 <sup>th</sup> Engineer Battalion, 3 ID (M), OIF
MAJ Michael Johnson	Executive Officer, TF 3-69 Armor, 3 ID (M), OIF
MAJ Benjamin Matthews	Fire Support Officer, 1 <sup>st</sup> Brigade, 3 ID (M), OIF
MAJ Ricky J. Nussio	Executive Officer, TF 1-64 Armor, 3 ID (M), OIF

MAJ Michael Oliver	S-3, TF 3-69 Armor, 3 ID (M), OIF
MAJ Philip Rice	S-3, 1-9 Field Artillery, 3 ID (M), OIF
MAJ Thomas Thompson	Special Operations Coordinator, V Corps, OIF
CPT Dunbar	Battery Commander, 1-39 Field Artillery (MLRS), 3 ID (M), OIF
CPT Todd Kelly	Infantry Company Commander, TF 3-69 Armor, 3 ID (M), OIF
CPT Jared Robbins	Tank Company Commander, TF 3-69 Armor, 3 ID (M), OIF



# Appendix C

## *Glossary*

A2C2	Army Airspace Command And Control
ABCS	Army Battle Command System
ABL	Ammunition Basic Load
ACE	Analysis and Control Element
ACO	Airspace Control Order
ACP	Assault Command Post
ACR	Airspace Coordination Request
ADC-M	Assistant Division Commander – Maneuver
ADE	Air Defense Element
ADOCS	Automated Deep Operations Coordination System
AFATDS	Advanced Field Artillery Tactical Data System
AHR	Attack Helicopter Regiment
AI	Air Interdiction
ALO	Air Liaison Officer
AMDWS	Air And Missile Defense Work Station
AR	Armor
ASARS	Advanced Synthetic Aperture Radar System
ASAS	All-Source Analysis System
ASAS-L	All-Source Analysis System-Light
ASOC	Air Support Operations Center
ASOG	Air Support Operations Group
ASR	Alternate Supply Route (Ammunition Supply Rate)
ATACMS	Army Tactical Missile System
ATARS	Advanced Tactical Aerial Reconnaissance System
ATO	Air Tasking Order
BCT	Brigade Combat Team
BCTP	Battle Command Training Program
BDA	Battle Damage Assessment
BDE	Brigade
BFT	Blue Force Tracker
BG	Brigadier General (1 star)

BMP	Soviet-era design tracked armored infantry fighting vehicle (multiple variants)
BN	Battalion
BOS	Battlefield Operating System
BRDM	Soviet-era design wheeled reconnaissance vehicle (multiple variants)
BRT	Brigade Reconnaissance Troop
BTR	Soviet-era design wheeled armored infantry carrier (multiple variants)
C2	Command and Control
C2PC	Command and Control Personal Computer
C2V	Command and Control Vehicle
C4	Command, Control, Communications and Computers
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CAOC	Combined Air Operations Center
CAS	Close Air Support
CENTCOM	United States Central Command also shown as USCENTCOM
CFACC	Combined Forces Air Component Command
CF-COP	Counterfire Common Operational Picture
CFLCC	Combined Forces Land Component Command
CGS	Common Ground Sensor
C-Main	Corps Main Command Post
CO	Company, or Commanding Officer
COA	Course Of Action
COL	Colonel
COLT	Combat Observation Lasing Team
COMINT	Communications Intelligence
CONUS	Continental United States
COP	Common Operational Picture
COSCOM	Corps Support Command
CP	Command Post Or Checkpoint
CPT	Captain
C-Rear	Corps Rear Command Post
CSAR	Combat Search And Rescue
CSL	Center For Strategic Leadership

CSS	Combat Service Support
CSSCS	Combat Service Support Control System
C-TAC	Corps Tactical Command Post
DARPA	Defense Research Projects Agency
DFSCOORD	Deputy Fire Support Coordinator
DISCOM	Division Support Command
DIVARTY	Division Artillery
DMA	Defense Mapping Agency
D-Main	Division Main Command Post
DOCC	Deep Operations Coordination Cell
DOTMLPF	Doctrine, Organization, Training, Materiel, Leader And Education, Personnel, And Facilities
D-Rear	Division Rear Command Post
D-TAC	Division Tactical Command Post
DTED	Digital Terrain Elevation Data
DTLOMS	Doctrine, Training, Leader Development, Organization, Materiel, And Soldiers
DTRACS	Defense Tracking, Reporting And Control System
DTSS	Digital Topographical Support System
EA	Engagement Area
ELINT	Electronic Intelligence
EPLRS	Enhanced Position Location Reporting System
EPW	Enemy Prisoner Of War
ERDC	U.S. Army Engineer Research And Development Center
EW	Electronic Warfare
FBCB2	Force XXI Battle Command Brigade And Below
FECC	Fires Effects Coordination Center
FLB	Forward Logistics Base
FLIR	Forward Looking Infrared
FM	Field Manual
FM	Frequency Modulated
FRAGO	Fragmentary Order
FSCL	Fire Support Coordination Line
FSCOORD	Fire Support Coordinator
FSE	Fire Support Element
FSO	Fire Support Officer

C-4

## Network Centric Warfare Case Study

G-1	Assistant Chief Of Staff, Personnel
G-2	Assistant Chief Of Staff, Intelligence
G-3	Assistant Chief Of Staff, Operations And Plans
G-4	Assistant Chief Of Staff, Logistics
G-5	Assistant Chief Of Staff, Civil Affairs
G-6	Assistant Chief Of Staff, Command, Control, Communications, And Computer Operations
G-7	Assistant Chief Of Staff, Information Operations
GBS	Global Broadcast System
GCS	Ground Control Station
GCCS	Global Command and Control System
GCCS-A	Global Command and Control System-Army
GPS	Global Positioning System
HHC	Headquarters and Headquarters Company
HMMWV	High-Mobility Multipurpose Wheeled Vehicle
HPTL	High Payoff Target List
HQ	Headquarters
HUMINT	Human Intelligence
IAEA	International Atomic Energy Authority
ID	Infantry Division
IFF	Identification, Friend Or Foe
IMINT	Imagery Intelligence
IN	Infantry
INFOSYS	Information Systems
IO	Information Operations
ISR	Intelligence, Surveillance, and Reconnaissance
ITM	Intra-air Targets Manager
JCOP	Joint Common Operational Picture
JDAM	Joint Direct Attack Munition
JDLM	Joint Deployment And Logistics Model
JSTARS	Joint Surveillance, Target Attack Radar System
JTIDS	Joint Tactical Information Distribution System
JTSTM	Joint Time Sensitive Targets Manager
LAN	Local Area Network
LNO	Liaison Officer
LOC	Line Of Communication

LOS	Line Of Sight
LRAS3	Long Range Advanced Scout Surveillance System
LTC	Lieutenant Colonel
LTG	Lieutenant General (3 star)
MAJ	Major
MANSCEN	U.S. Army Maneuver Support Center
MASINT	Measurement And Signature Intelligence
MCRP	Marine Corps Reference Publication
MCS	Maneuver Control System
MCS-L	Maneuver Control System-Light
MEF	Marine Expeditionary Force
MG	Major General (2 star)
MLRS	Multiple Launch Rocket System
MOSP	Multi-mission Optronic Sensor Payload
MOUT	Military Operations on Urbanized Terrain
MSE	Mobile Subscriber Equipment
MSR	Main Supply Route
MTS	Movement Tracking System
NCO CF	Network Centric Operations Conceptual Framework
NCW	Network Centric Warfare
NEW	Network Enabled Warfare
NSL	No Strike List
NTC	National Training Center
OBJ	Objective
OFT	Office Of Force Transformation
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OODA	Observe-Orient-Decide-Act
OP	Observation Post
OPLAN	Operations Plan
OPORD	Operations Order
OPSEC	Operational Security
OPTEMPO	Operational Tempo
OSD	Office of the Secretary of Defense
PAA	Position Area for Artillery
PL	Phase Line

PLGR	Precise Lightweight Global Positioning System Receiver
PLT	Platoon
PSYOPS	Psychological Operations
RCC	Rescue Coordination Center
ROE	Rules Of Engagement
RPG	Rocket Propelled Grenade
RSO&I	Reception, Staging, Onward Movement, And Integration
RTL	Restricted Targets List
S-1	Personnel Staff Officer
S-2	Intelligence Staff Officer
S-3	Operations Staff Officer
S-4	Logistics Staff Officer
S-5	Civil-Military Operations Officer
S-6	Command, Control, Communications And Computer Operations (C4OPS) Officer
S-7	Information Operations Officer
SADARM	Sense And Destroy Armor Munition
SAR	Search And Rescue
SAR/MTI	Synthetic Aperture / Moving Target Indicator
SATCOM	Satellite Communications
SCAR	Strike Coordination And Reconnaissance
SIGINT	Signals Intelligence
SINCGARS	Single Channel Air-Ground Radio System
SJA	Staff Judge Advocate
SOCOORD	Special Operations Coordinator
SOF	Special Operations Forces
SOP	Standing Operating Procedures
TACP	Tactical Air Control Party
TACSAT	Tactical Satellite
TAIS	Tactical Airspace Integration System
TBMCS	Theater Battle Management Core System
TCE	TeleEngineering Communications Equipment
TEOC	TeleEngineering Operations Center
TF	Task Force
TLAM	Tomahawk Land Attack Missile
TOC	Tactical Operations Center

TRADOC	United States Army Training and Doctrine Command
TSC	Theater Support Command
TST	Time Sensitive Target
TTP	Tactics, Techniques, and Procedures
UAV	Unmanned Aerial Vehicle
UBL	Unit Basic Load
UHF	Ultra High Frequency
UN	United Nations
UNSCOM	United Nations Special Commission
UNSC	United Nations Security Council
UNSCR	United Nations Security Council Resolution
USAF	United States Air Force
USAWC	United States Army War College
USCENTCOM	United States Central Command
USEUCOM	United States European Command
USMC	United States Marine Corps
USSOCOM	United States Special Operations Command
VHF	Very High Frequency
WARNO	Warning Order
WMD	Weapon(s) Of Mass Destruction
XO	Executive Officer (Normally the second In command of a Company, Battalion, or Brigade)



## Appendix D

### *Technical Systems*

This appendix provides brief descriptions of the following key C4I systems:

- Blue Force Tracker (BFT)
- AN/PSC 5 Spitfire Tactical Satellite Radio (TACSAT)
- Automated Deep Operations Coordination System (ADOCS)
- Hunter Unmanned Aerial Vehicle (UAV)
- Long Range Advanced Scout Surveillance System (LRAS3)
- TeleEngineering
- Iridium Satellite Phones

Further information on these and other systems may be found by using the links provided in Table D-1.

## Blue Force Tracker

***“FBCB2 helped prevent fratricide and enabled U.S. commanders to conduct operations at a much more rapid pace than the enemy. I simply never want to go into combat without FBCB2 – it’s that good.”***

— Commander, TF 1-15 Infantry, 3 ID (M)

The blue force tracker (BFT) was one of the most widely praised command and control (C2) systems of the maneuver phase of Operation Iraqi Freedom. It provided unprecedented situational awareness from the lowest tactical level to the highest strategic level.

The Force XXI Battle Command Brigade and Below (FBCB2) is a digital command and control (C2) system consisting of both hardware and software integrated into platforms primarily at brigade and below. The system provides an automated network enabled C2 system facilitating the flow of battle command tactical mission requirements. It interfaces with Army and Joint C2 and other sensor systems on the battlefield, resulting in vertical and horizontal information integration. This shared common battlefield picture—or common operational picture (COP)—displays near-real-time information that contributes to situational awareness, provides graphics and overlays, and allows the exchange of C2 messages. The FBCB2 now comes in two variants. The standard FBCB2 using the enhanced positioning location and reporting system (EPLRS) is a terrestrial-based system and was developed as part of the Army Battle Command System development process. The FBCB2 fielded for Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) was the FBCB2-BFT, a satellite based version of the FBCB2-EPLRS, which was rapidly developed and procured outside of the standard development and procurement process.



Figure D-1. Networking the Force: FBCB2/BFT install on U.S. Forces During OIF

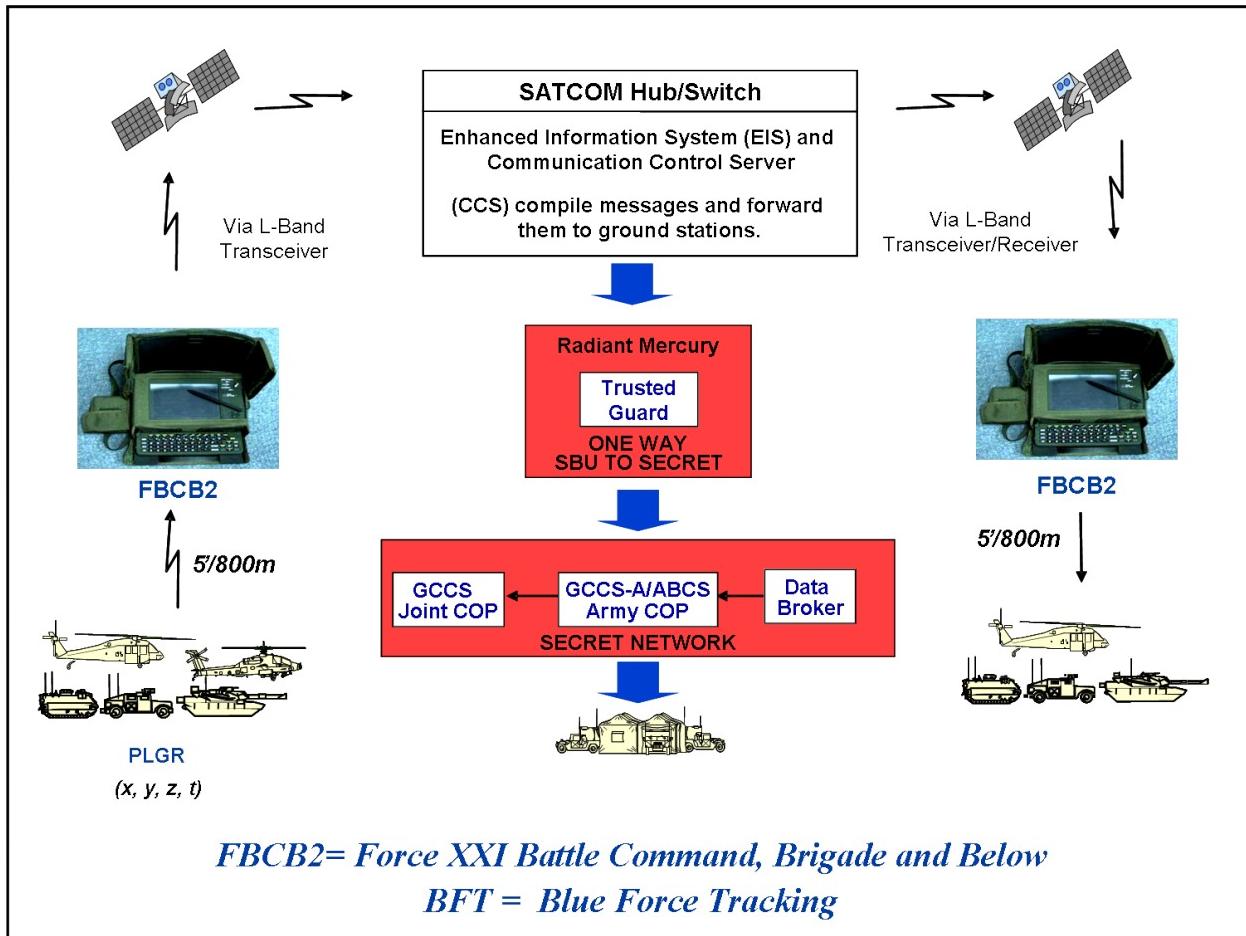


Figure D-2. Networking the Force: Employment of FBCB2/BFT during OIF

The standard FBCB2-EPLRS is a digital C2 system for brigade and below application that is part of the Army's digitized force known as the Army Battle Command System (ABCS). The FBCB2-EPLRS was developed during the mid-1990s and was fielded and concept proven with the 4<sup>th</sup> Infantry Division and 1<sup>st</sup> Cavalry Division at Ft. Hood, Texas as the first divisions in a digitized force. The FBCB2-EPLRS is a terrestrial-radio based line-of-sight system that relies on a dense population of systems in order to maintain connectivity for network integrity and maintenance of the common operational picture (COP). The line-of-sight requirement is a limitation for a widely dispersed force. The EPLRS-based system is communications accredited (hardware encrypted) for both unclassified and secret information processing and can interface into the ABCS. It provides the user a wide set of tools, including navigational and map tools, self location provided through the precision lightweight GPS receiver (PLGR) equipment, digital terrain elevation data, point-to-point and circular terrain analysis tools, reports tools, text messaging, and other tools.

The FBCB2-BFT that was fielded for OEF and OIF escaped the terrestrial line-of-sight limitations associated with the FBCB2-EPLRS. The BFT version, with its L-band transceiver satellite link, provided over-the-horizon capabilities and thereby reduced the need for a dense population of closely associated systems to maintain network integrity. Because of bandwidth limitations, BFT did not have the complete set of tools as provided by EPLRS; however, BFT provided many of

## Network Centric Warfare Case Study

the same capabilities. BFT provided the same map and navigational tools, GPS, digital terrain elevation data, terrain analysis tools, and a limited text messaging capability. The BFT was not ABCS interoperable because it lacked the hardware encrypted secure communications accreditation, but relied on digital encryption with a one-way entry into Global Command and Control System-Army (GCCS-A). This one-entry allowed for populating the COP and dissemination of the blue picture across the classified GCCS network. All FBCB2-BFT-equipped platforms within the network also received the locations of all other BFT systems within the network. There was a capability to separate out organizations from the widely disseminated display; this was used for special operations forces locations. The generated COP was a near real-time picture of the blue forces. The BFT update rate was every 5 minutes or a movement of 800 meters for ground vehicles and every minute or 2300 meters for air.<sup>1</sup>

Both FBCB2-EPLARS and FBCB2-BFT can be locally or remotely challenged and destroyed if compromised by erasing the computer hard drive.

**TACSAT****SPITFIRE***Figure D-3. TACSAT Radio*

The AN/PSC 5 “Spitfire” single-channel tactical satellite (S/C TACSAT) radio was the single most lauded radio of the war. “Singular best and most reliable form of communication for the Corps. Saved lives and kept the CG [commanding general] informed and command enabled 24/7.”<sup>22</sup> “The wide band single channel TACSAT won the war for us. This was the only reliable means of long range communications and my primary situational awareness tool.”<sup>23</sup>

The single-channel tactical satellite (S/C TACSAT) radio mission is to provide tactical communications such as in-route contingency communications, in-theater communications, intelligence broadcast, and combat net radio range extension.

Single-channel satellite communications provides reliable worldwide communications; it is highly transportable in both man-pack and vehicular configurations, and it provides the “Warfighters Net” capability for corps and division.

The requirement for wideband, 25 kHz, S/C TACSAT at the division level and below was not widely acknowledged before the war, and tactical commanders played limited roles in the pre-war apportionment conferences. High Frequency, Demand Assigned Multiple Access (DAMA) and 5 kHz channels were completely ineffective as C2 nets, and 25 kHz UHF channels with low look-up angles were failures. The low look-up angle satellites suffered from greater topographic interference, and it was difficult to keep antennas aligned while on the move. The numbers of available military communications satellites that supported maximum look up angles were limited over the CENTCOM area of responsibility. To support C2 on the move, the satellites need to be positioned almost directly overhead.

For the period of this study, V Corps and its units had only five assigned wideband 25 kHz channels to fight what had clearly become unconnected formations broadly dispersed across areas that far exceeded the range capabilities of the fielded FM radios. V Corps and 3 ID(M) each used their assigned 25 kHz TACSAT channels to establish the Corps and Division command nets.

## Automated Deep Operations Coordination System

The ADOCS was highly praised by both the V Corps and 3 ID(M) users. ADOCS merges data from multiple sources. Throughout the war, the Corps FECC used ADOCS as the system of choice to develop and attack targets. In the case of targeting, ADOCS was able to display the merged data from multiple intelligence intercepts (INTs) and graphically display it against other targeting information, such as the No Strike List, Restricted Target List, and Indirect Fire capabilities. ADOCS also allowed the targeting officers to conduct terrain association between UAV feeds and satellite photos to validate target grid locations. ADOCS enabled quicker collaboration and decision making during the targeting process and resulted in the ability to attack targets more quickly than had previously been possible.

The Automated Deep Operations Coordination System (ADOCs) is a joint mission management software application. It provides a suite of tools and interfaces for horizontal and vertical integration across battle space functional areas. Originating as a Defense Research Projects Agency (DARPA) program, ADOCS has evolved into the “go to war” automated support system for deep operations in several theaters. It is currently installed on over 5,000 systems worldwide. ADOCS is also a major segment of the intelligence application package for Theater Battle Management Core System (TBMCS) functionality at wing and squadron level. Key integration functions within ADOCS are Joint Time Sensitive Target management, Intra-Air Operations Center Targets management, Air Tasking Order planning, Indirect Fires management, Counterfire and Artillery Common Operational Picture, Combat Search and Rescue, Air and Ground Battlefield Management, and No Strike and Restricted Target lists maintenance. ADOCS is also expanding by increasing the number of interfaces it supports to other battle command systems, both U.S. and coalition.

ADOCs was labeled one of the “un-sung heroes” of Operation Iraqi Freedom for its ability to close the seams between the varied service-specific battle command systems. Through the integration of multiple sources of information, ADOCS was a uniquely capable total mission integration and coordination system. Not only did ADOCS portray the Common Operational Picture to display the state of the battle, but ADOCS was capable of using that information to streamline the necessary steps in mission coordination and execution. Deployed with the smallest detachments all the way up to the Combined Joint Task Force Headquarters, ADOCS has lived up to its billing: planning, coordinating, and executing with horizontal and vertical integration across the Joint battle space.

The Joint Time Sensitive Targets Manager (JTSTM) in ADOCS allows for target creation, vetting, coordination, and execution across the Joint Command structure. It is tailored to allow the Unified Combatant Commander to use all of the weapons systems in the joint battle space to engage time-sensitive targets.

The Intra-AOC Targets Manager (ITM) provides a tool for the Air Operations Center to coordinate and engage those targets that have a significant impact on the conduct of the air battle. The ITM allows the users to coordinate, deconflict, match aircraft to the target, and submit a request to TBMCS for a change to the ATO. The digital coordination and deconfliction features of this manager greatly reduce detect-to-destroy times for AOC critical targets. The ITM is also capable of linking its mission data to the JTST, ISR, and Fires managers in ADOCS for Joint visibility and engagement.

The Intelligence, Surveillance, and Reconnaissance (ISR) Manager in ADOCS allows the intelligence community to coordinate multiple collection platforms in a synchronized collection effort on a target. Following the cross-queue collection effort, ADOCS has the ability to pass the mission to its other target execution managers. Similarly, the JTST and ITM managers in ADOCS can send missions to the ISR Manager for detailed collection prior to determining the execution course of action.

The Air Tasking Order Planning and Execution function provides more effective employment of air assets through timely and improved information flow for the identification, nomination, and assignment of targets. It enables the service level commander and staff to allocate critical air resources in a more efficient manner through early assessment of potential and planned missions. ADOCS also provides the ability to monitor ATO execution through all phases and provides immediate visibility of air nominations throughout the targeting process, including distributed 8- and 4-hour updates to allow for detailed target validation prior to strike. ADOCS also supports analysis to assess the changes and movements of the Fire Support Coordination Line (FSCL) on current and planned missions in the ATO. It provides immediate visibility of targets exposed or covered by movements in the FSCL.

Automated Deep Operations Coordination System							
	<table border="1"> <thead> <tr> <th>Description</th><th>Key Points</th></tr> </thead> <tbody> <tr> <td> <b>ADOCS</b>   </td><td> <p>A mission management coordination tool providing integrated battlespace information.</p> <ul style="list-style-type: none"> <li>• Provides mission management coordination support.</li> <li>• Horizontal and vertical coordination and integration across BOS.</li> <li>• Joint service use</li> <li>• Distributed collaboration</li> <li>• Integrates with:           <table border="0"> <tr> <td style="vertical-align: top;">           – AFATDS            – GCCS            – TAIS            – TBMCS            – IPL (imagery)            – JWS (weather)         </td><td style="vertical-align: top;">           – Radars            – ASAS/RWS            – CGS / UAV            – IFSAS            – C2PC            – ADSI (air tracks)         </td></tr> </table> </li> </ul> </td></tr> </tbody> </table>	Description	Key Points	<b>ADOCS</b> 	<p>A mission management coordination tool providing integrated battlespace information.</p> <ul style="list-style-type: none"> <li>• Provides mission management coordination support.</li> <li>• Horizontal and vertical coordination and integration across BOS.</li> <li>• Joint service use</li> <li>• Distributed collaboration</li> <li>• Integrates with:           <table border="0"> <tr> <td style="vertical-align: top;">           – AFATDS            – GCCS            – TAIS            – TBMCS            – IPL (imagery)            – JWS (weather)         </td><td style="vertical-align: top;">           – Radars            – ASAS/RWS            – CGS / UAV            – IFSAS            – C2PC            – ADSI (air tracks)         </td></tr> </table> </li> </ul>	– AFATDS – GCCS – TAIS – TBMCS – IPL (imagery) – JWS (weather)	– Radars – ASAS/RWS – CGS / UAV – IFSAS – C2PC – ADSI (air tracks)
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*Figure D-4. The Automated Deep Operations Coordination System (ADOCS)*

ADOCS contains mission managers that allow the user to coordinate and execute indirect fires, including tube artillery multiple launch rocket systems, ship fired missiles, and coordinated engagements by seaborne Special Operations Forces. Not only does ADOCS have the ability to weapon target pair and begin the engagement process, it also performs conflicts checks against the targets to ensure there is no unnecessary collateral damage or fratricide.

The Counterfire Common Operational Picture (CF-COP) function provides a near real-time picture of the artillery battle. It allocates tube and rocket counter-battery resources for more efficient counterfire operations through digital integration at multi-echelons: from Joint/Combined level down to tactical firing units. CF-COP also includes munitions allocation and weapon system status. Weapon-target pairing provides improved use of available munitions to maximize lethality while conserving time and munitions for follow-on engagements.

The Combat Search and Rescue (CSAR) manager in ADOCS allows the local rescue coordination center to plan, coordinate, and execute search and rescue operations across the Joint battlefield. By consolidating all of the critical information elements into an in-depth mission roll-up, the agencies involved in Personnel Recovery are able to view and track the progress of the recovery operation. ADOCS uses the ATO to automatically recommend recovery assets for direct pairing with a particular mission. The CSAR manager also allows dynamic tasking of other assets to assist in the recovery operation.

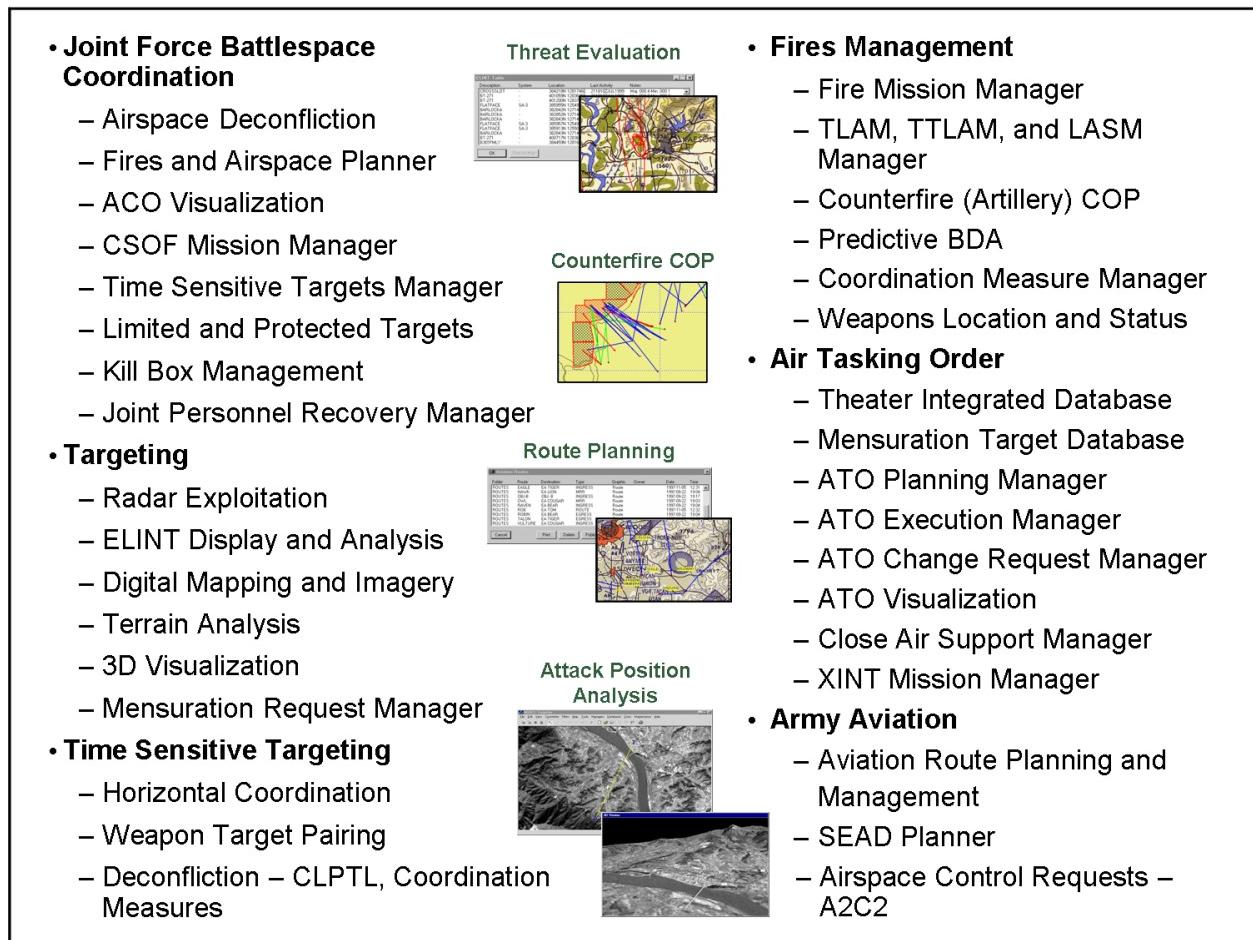


Figure D-5. ADOCS Mission Managers and Tools

ADOCS supports coordination of certain air space through its Airspace Coordination Request (ACR) manager. The ACR Manager can conduct time and altitude, zone, and corridor deconfliction. ADOCS also allows air space requests to be modified and coordinated across boundary lines and through the echelons. The ACR manager is also seamlessly integrated with the Tactical Airspace Integration System (TAIS) for airspace management and visibility. ADOCS can display the

Airspace Control Order (ACO) from both TAIS and TBMCS and constantly compares missions against the protect airspace to alert the users of potentially dangerous conflicts.

The Battle Space Visualization function enables improved situational awareness, faster and more accurate deep attack planning, and battle space assessment. It uses tools that provide visualization of coordination measures, ingress and egress routes, and air defense threats. Battle Space Visualization also enables combatant commanders and staff to visualize friendly fires in 3D space over any area. Battlefield geometries can also be overlaid with imagery and terrain data to improve situation awareness and planning.

Although ADOCS is not a source of the No Strike List (NSL) or Restricted Targets List (RTL), these two essential target lists are present in ADOCS and are constantly referenced in all phases of mission development in ADOCS. As soon as a target is created in ADOCS, both of these lists are checked to make sure that the Collateral Damage estimated for the target is not in the protected target areas contained in the NSL and RTL. ADOCS also allows for users to add additional targets to the NSL and RTL while coordinating these additions across the service and joint operations centers.

The base of ADOCS power is in its ability to accept multiple different data elements from the entire spectrum of C4I systems.



*Figure D-6. The Hunter Unmanned Aerial Vehicle*

“Hunter<sup>4</sup> is a joint tactical unmanned aerial system in service with the U.S. Army. In 1989, the U.S. Army, Navy and Marines initiated a joint unmanned aerial vehicle program. TRW (now Northrop Grumman) and Israeli Aircraft Industries (IAI) Malat Division won a low rate initial production (LRIP) contract in 1993 to supply seven Hunter systems. The systems entered service in 1996. Hunter has also been sold to France and Belgium.”

“The Hunter system is capable of carrying out the following missions: real time imagery intelligence, artillery adjustment, battle damage assessment, reconnaissance and surveillance, target acquisition and battlefield observation.”

#### **RQ-5A**

“The RQ-5A Hunter air vehicle is a fixed wing, twin tail boom aircraft with a dual rudder. It is propelled by two Moto-Guzzi petrol engines, each developing 60hp.”

“The air vehicle can be launched from a paved or semi-paved runway or it can use a rocket assisted (RATO) system, where it is launched from a zero-length launcher using a rocket booster. The RATO launch is useful on board small ships and in areas where space is limited. The air vehicle can land on a regular runway, grassy strip or highway using arresting cables.”

#### **Payloads**

“The primary payload on the RQ-5A is the Multi-Mission Optronic Payload (MOSP), which includes television and forward looking infrared (FLIR) to provide day / night surveillance capability. U.S. Army Hunters are being fitted with sensors including a third-generation FLIR and a spotter for the day TV camera.”

“Hunter is capable of carrying other advanced mission payloads and has been used as a payload demonstration platform. Payloads have included a laser designator and various communications

systems. A communications relay payload extends VHF/UHF communications beyond line of sight. Electronic countermeasures payloads have included communications warning receiver, communications jammer and radar jammer supplied by Northrop Grumman. In June 2003, Northrop Grumman tested a Hunter UAV equipped with a SAR/MTI (synthetic aperture/moving target indicator) radar payload.”

### **Ground Control Station**

“The GCS-3000 Ground Control Station manned by two operators, tracks, commands, controls, and communicates with the air vehicle and its payload. One ground control station can control one air vehicle or two air vehicles in relay. An enhanced mission planner provides flexible automated tactical mission planning and access to digital terrain elevation data (DTED), CD ROM map data and data from the Defense Mapping Agency (DMA).”

“The GCS has three control bays and an optional intelligence bay. The Pilot Control Bay controls the flight of the air vehicle. An Observer Control Bay controls the payload functions. The navigation control bay is equipped with a digital map display which traces the flight path and monitors the progress of the mission. The intelligence bay provides data processing and distribution capabilities.”

“The communications uplink channels (UPL-1 and UPL-2) and the downlink channel (DNL) use fixed coded frame format. An optional spread spectrum modem on the main uplink channel provides anti-jam capability.”

### **Remote Video Terminal**

“A Remote Video Terminal is used at tactical operations centers to receive and display real-time video and telemetry from the airborne vehicle.”

## Network Centric Warfare Case Study

### LRAS3

The LRAS3 is a second generation forward looking infrared (FLIR) system with long-range optics, an eye-safe laser rangefinder, a low-light television camera, and a global positioning system (GPS) with altitude determination. It is a digital system capable of exporting targeting information to the Force XXI Battle Command, Brigade-and-Below (FBCB2) System.<sup>5</sup> However, during OIF, the LRAS3s in use were not digitally linked. They lacked the necessary cables to provide the digital linkage because of early delivery of systems for the war. Additionally, the LRAS3s were not otherwise capable of sending data over the blue force tracker system which sends data over L-band satellite.<sup>6</sup>

The LRAS3 is capable of target identification and providing ten digit grid readouts of targets beyond 10 kilometers with a 60 meter circular error probability.

The LRAS3 operates line-of-sight and provides real-time acquisition, target detection, recognition, and location information, and is capable of 24-hour and adverse weather operation.

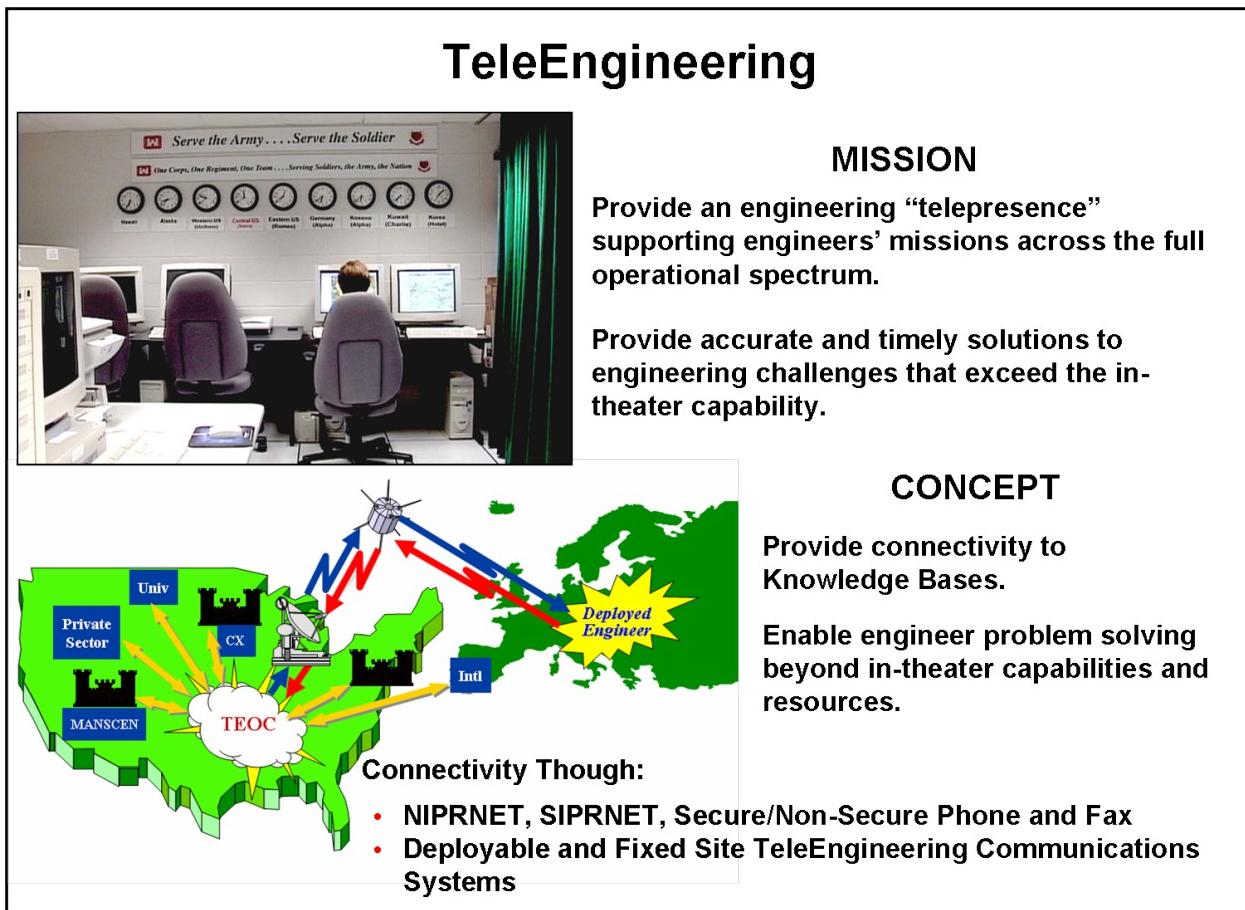


*Figure D-7. The Long Range Advanced Scout Surveillance (LRAS3)*

## TeleEngineering

TeleEngineering Operations is a technology concept in use by the U.S. Army Engineer Research and Development Center (ERDC) under the proponency of the U.S. Army Maneuver Support Center. TeleEngineering is simply “distance” or “reach back” engineering. When a complex problem is encountered in the field, soldiers can quickly send information via advanced communications links to the TeleEngineering Operations Center (TEOC). The Center can tap the technical expertise of the Corps of Engineers research laboratories, Corps’ districts and divisions, private industry, and academia to rapidly provide an answer to the problem.

While the TeleEngineering name is fairly new, the basic concept has been a cornerstone of Corps service for years. The catalyst has been advanced high-speed communications that link the people with the problems to the people with the answers.



*Figure D-8. TeleEngineering: Mission and Concept*

There are two different versions of the TeleEngineering Communications Equipment (TCE): a fixed-site version that is used in garrison (TCE-F), and a deployable (TCE-D) version that has been ruggedized for field use. The systems consist of a Polycom ViewStation capable of H.320 based conferencing, a Panasonic Toughbook, an encryption device, external hand-held camera, and other miscellaneous pieces. The deployable system uses auto-switching dual voltage power supplies and can operate from 110V to 220V AC and can also operate using vehicle battery power.

Depending on their configuration, the systems can communicate point-to-point or they can be connected through a multipoint VTC bridge at the ERDC TEOC to allow up to forty-four users in a secure VTC at a time. The data transfer rate and video connection for the deployable system is typically 64 kbs; this can be increased by adding additional satellite terminals. The system can also be used to send and receive non-secure e-mail traffic.<sup>7</sup>

## TeleEngineering Components

### TeleEngineering Toolkit Software



### TeleEngineering Communications Equipment Deployable (TCE-D)

- Provides a deployable secure and non-secure VTC and data transfer capability.



### Automated Route Reconnaissance Kit (AARK)

- Provides equipment and software to simplify and expedite mounted route reconnaissance mission.



*Figure D-9. The Components of TeleEngineering*

## Iridium Satellite Phones

± Radio Classification	
Technology	Digital
Spectrum	1616-1626.5 MHz, L-band
Orientation	Satellite
Mobility	Handheld
Power	0.57 watts average
Distance	SATCOM
Operational Mode	Voice, data
Encryption	Iridium Security Module (ISM) provides National Security Agency (NSA) Type 1 encryption approved protection to the Top Secret level

± System Description

The Enhanced Mobile Satellite Service (EMSS) Iridium Handset Series 9505 satellite telephone is a lightweight, handheld Future Narrow Band Digital Terminal (FNBDT) compatible device designed to provide users worldwide secure voice connectivity in mobile environments as well as secure voice connectivity to desktop STU-IIIIs and compatible equipment (e.g. Secure Terminal Equipment (STEs)).



**Iridium Phone**

*Figure D-10. The Iridium Satellite System*

Iridium is a commercial enterprise delivering satellite-based communications services to and from remote areas where no other form of communication is available. The Iridium constellation of sixty-six low-earth orbiting (LEO), cross-linked satellite operates as a fully meshed network and is the largest commercial satellite constellation in the world. Iridium provides service to the U.S. Department of Defense and was widely used during OIF, especially by combat service support organizations as their only means of long range communications.

**Network Centric Warfare Case Study**

Table D-1 is provided to assist the reader in finding additional information.

ABCS	<a href="http://www.defensedaily.com/progprof/army/abcs.pdf">http://www.defensedaily.com/progprof/army/abcs.pdf</a> <a href="http://www.fas.org/man/dod-101/sys/land/abcs.htm">http://www.fas.org/man/dod-101/sys/land/abcs.htm</a>
ADOCS	<a href="http://www.gdc4s.com/Products/adocs.htm">http://www.gdc4s.com/Products/adocs.htm</a>
AFATDS	<a href="http://www.fas.org/man/dod-101/sys/land/afatds.htm">http://www.fas.org/man/dod-101/sys/land/afatds.htm</a> <a href="http://www.raytheon.com/products/afatds/">http://www.raytheon.com/products/afatds/</a>
AMDWS	<a href="http://bctc.hood.army.mil/wbt/fbcb2/00_glossary/amdws.htm">http://bctc.hood.army.mil/wbt/fbcb2/00_glossary/amdws.htm</a> <a href="http://www.defensedaily.com/progprof/army/amdpcs.pdf">http://www.defensedaily.com/progprof/army/amdpcs.pdf</a>
C2PC	<a href="http://home.inri.com/products/c2pc.html">http://home.inri.com/products/c2pc.html</a> <a href="http://www.globalsecurity.org/intell/library/reports/2001/compendium/c2pc.htm">http://www.globalsecurity.org/intell/library/reports/2001/compendium/c2pc.htm</a>
DTRACS	<a href="http://www.titan.com/products-services/load_pdf.html?filename=86_1053001002.pdf">http://www.titan.com/products-services/load_pdf.html?filename=86_1053001002.pdf</a>
EPLRS	<a href="http://www.gordon.army.mil/tsmtr/eplrs.htm">http://www.gordon.army.mil/tsmtr/eplrs.htm</a> <a href="http://www.raytheon.com/products/eplrs/">http://www.raytheon.com/products/eplrs/</a> <a href="http://www.fas.org/man/dod-101/sys/land/eplrs.htm">http://www.fas.org/man/dod-101/sys/land/eplrs.htm</a> <a href="http://www.raytheon.com/products/eplrs/">http://www.raytheon.com/products/eplrs/</a>
FBCB2	<a href="http://peoc3t.monmouth.army.mil/FBCB2/fbcb2.html">http://peoc3t.monmouth.army.mil/FBCB2/fbcb2.html</a>
GCCS	<a href="http://www.fas.org/nuke/guide/usa/c3i/gccs.htm">http://www.fas.org/nuke/guide/usa/c3i/gccs.htm</a>
Hunter UAV	<a href="http://www.army-technology.com/projects/hunter/">http://www.army-technology.com/projects/hunter/</a>
JDLM	<a href="http://www.tapestrysolutions.com/index.php?Option=JDLM">http://www.tapestrysolutions.com/index.php?Option=JDLM</a> <a href="http://www.amso.army.mil/BCSEtopics/sim-sys/joint/jdlm.htm">http://www.amso.army.mil/BCSEtopics/sim-sys/joint/jdlm.htm</a> <a href="http://www.21tsc.army.mil/SimCenter/jdlm.html">http://www.21tsc.army.mil/SimCenter/jdlm.html</a>
LRASSS	<a href="http://www.raytheon.com/products/lras3/">http://www.raytheon.com/products/lras3/</a> <a href="http://www.sec.army.mil/aiew/Branches/Sensors/systems/lras3/lras3.htm">http://www.sec.army.mil/aiew/Branches/Sensors/systems/lras3/lras3.htm</a>

MCS	<a href="http://www.fas.org/man/dod-101/sys/land/mcs.htm">http://www.fas.org/man/dod-101/sys/land/mcs.htm</a>
MSE	<a href="http://www.fas.org/man/dod-101/sys/land/mse.htm">http://www.fas.org/man/dod-101/sys/land/mse.htm</a>
MTS	<a href="http://www.comtechmobile.com/cmdc/MTS.html">http://www.comtechmobile.com/cmdc/MTS.html</a>
SINCGARS	<a href="http://webhome.idirect.com/~jproc/crypto/sincgars.html">http://webhome.idirect.com/~jproc/crypto/sincgars.html</a> <a href="http://www.fas.org/man/dod-101/sys/land/sincgars.htm">http://www.fas.org/man/dod-101/sys/land/sincgars.htm</a>
TAIS	<a href="http://www.gdds.com/tais/main.html">http://www.gdds.com/tais/main.html</a>
TACSAT	<a href="http://www.monmouth.army.mil/peoc3s/trcs/MF1SPITF.htm">http://www.monmouth.army.mil/peoc3s/trcs/MF1SPITF.htm</a>
TBMCS	<a href="http://jtc.fhu.disa.mil/gccsiop/interfaces/tbmcs.htm">http://jtc.fhu.disa.mil/gccsiop/interfaces/tbmcs.htm</a> <a href="http://www.fas.org/man/dod-101/sys/ac/equip/tbmcs.htm">http://www.fas.org/man/dod-101/sys/ac/equip/tbmcs.htm</a>
TeleEngineer	<a href="http://asc.army.mil/docs/pubs/alt/current/issue/articles/22_TeleEngineering_200501.pdf">http://asc.army.mil/docs/pubs/alt/current/issue/articles/22_TeleEngineering_200501.pdf</a>

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## **ENDNOTES**

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3. This was a comment provided on a survey conducted of officers and their OIF experiences. The comment is representative of other survey comments and interview comments provided by senior officers.
4. The following description of the Hunter is taken from (2006) *HUNTER RQ-5A/MQ-5B/C TACTICAL UNMANNED AERIAL VEHICLE, USA/ISRAEL*, Army-technology.com, 2006 SPG Media Limited, a subsidiary of SPG Media Group PLC, 2006.
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6. Information based on telephone conversation with LTC Edward J. Stawowczyk and Michael B. O'Hara, LRAS3 Project Leader/PM FLIR, 16 March 2006.
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# **Appendix E**

## *Senior Officer Interview Questionnaire*

### **Senior Officer Interview**

Our goal is to capture vignettes and quantify any improvements in increased decision making, agility, and synchronization of combat power from the tactical through the operational level of war.

The focus timeframe for the purposes of this interview is from 20 Mar through 1 May 2003.

The hypothesis of the study is that a robustly networked force improves information sharing and collaboration, which enhances the quality of information and shared situational awareness. This enables further collaboration and self-synchronization and improves sustainability and speed of command, which ultimately results in dramatically increased mission effectiveness.

In order to help us test this hypothesis, this interview is broken down into three main sections. The first relates to you, your information needs, and your decision making. The second relates to whether information systems actually increased information awareness for you, your subordinates, and your staff, and what impact this increased awareness had on the application of the principles of war and tenets of Army operations. The final section is quantitative in nature and asks you to compare your OIF combat experiences with your previous experiences.

1. Describe the scope of your duties and responsibilities during OIF.
2. Describe the role of your unit / organization and its objectives during this (20 Mar – 1 May) timeframe.
3. As part of the preparations for combat your unit / organization received new information systems. Had you been briefed as to the extent of the distribution and the capabilities of the new systems? What role did you play in their distribution?
4. Did any of the new systems provide you with new or more efficient capabilities? (In terms of your ability to make better or faster decisions, synchronize operations, collaborate with your subordinates and your staff.)
5. Were any changes in procedures implemented as a result of any of the new information system capabilities? If there were no changes, should there have been?
6. During combat operation, what system or combination of systems provided you the most timely and accurate information?

7. Where did you physically locate yourself during combat operations?
8. If located forward, why, what advantage did that provide?
9. Describe your decision-making process?
10. Considering the type and quality of information you had during combat operations as compared to your previous experiences, did your decision-making process (planning / coordination) change, and if so how?

Speed: Slower      Same      Faster      Much Faster      Significantly Faster

Confidence:      Less      Same      More      Much More      Significantly More

11. What type of information did you consider most critical for your situational awareness?
12. How did you receive this information?
13. Who else needed this same information and how was it shared?
14. If you had increased situational awareness, did you find your role / function changing?
15. Did you notice a difference in your dialogue with your staff or subordinate commanders?
16. Did you issue planning guidance differently? Was the planning guidance more or less detailed?
17. How did you manage your forces?
18. How far out in time and space were you focused / fighting?
19. Did the way you actually conducted warfighting differ from the way you previously trained? If so, how? Was this attributable to increased information capabilities / situational awareness?
20. Given: All staff officers use the estimate of the situation to collect and analyze information for developing, within the time limits and information available, the most effective solution to a problem.

Did you observe any changes to this estimate process?

21. Was information overload ever a problem for you or your staff? How did you (or they) handle this?

During this next section please think about the impact increased situational awareness and information technologies had on your application of the principles of war and the tenets of Army operations.

22. Was there any impact on your ability to push and coordinate the offensive? (seize, retain, and exploit the initiative).

23. Were there any impacts on your ability to concentrate the effects of joint combat power?

24. Were there any impacts on economy of force missions? Were these conducted with reduced risk?

25. What about maneuver? (Ability to place the enemy in a disadvantageous position through the flexible application of combat power)

26. Did any new information systems impact your ability to ensure unity of command and effort?

27. Was there any impact on security?

28. Was there any impact on surprise?

29. Did any information system allow you achieve greater simplicity in communicating your intent in a concise, clear, and uncomplicated manner?

30. What was the impact of situational awareness in terms of setting or dictating the terms of action throughout the battlespace?

31. What was the impact of situational awareness in terms of force agility?

32. Did your situational awareness allow you to extend operational depth (in terms of time, space, and resources)?

33. What were the most notable impacts on the synchronization of activities across the battlespace?

This is the quantitative section of the interview. We are asking you to compare your OIF combat experiences against your previous experiences.

34. How important was it to you to have accurate and timely situational awareness?

Prior Experience      OIF Experience

- Not important
- Somewhat important
- Important
- Very important
- Extremely important

35. How accurate was the information you typically received (meaning that your awareness provided a “picture” of the battlespace that was consistent with ground truth)?

Prior Experience      OIF Experience

- Not accurate
- Marginally accurate
- Generally accurate
- Almost always accurate
- Always accurate

36. To what extent did the flow and timeliness on information allow you to coordinate your action/operations among your units (PLTs, COs, BNs, BDEs, or DIVs) and/or other services?

Prior Experience      OIF Experience

- Not good
- Adequate
- Good
- Very Good
- Extremely Good

37. To what extent did the increased quantity and quality of information and timeliness of the information provided allow you to modify the planning process or modify your plans?

Prior Experience      OIF Experience

- No time for modification/refinement
- Some time for modification/refinement
- Adequate time for modification/refinement
- Much more time for modification/refinement
- Significantly more time for modifications/refinement

38. How would you rate the ability to share information, and coordinate actions/capabilities?

	Prior Experience	OIF Experience
Not good		
Somewhat good		
Good		
Very good		
Extremely good		

39. To what extent did you usually become aware of key battlespace elements (BOS) in time to make the decisions you needed to make?

	Prior Experience	OIF Experience
Difficult, not frequently		
Somewhat frequently		
Frequently		
Almost always		
Always		

40. To what extent did you feel that your awareness of key battlespace elements (BOS) was complete (meaning that you were aware of everything you needed to be aware of)?

	Prior Experience	OIF Experience
Difficult, not frequently		
Somewhat frequently		
Frequently		
Almost always		
Always		

41. To what extent did you think you had an adequate understanding of the situation (meaning that you felt you had enough information and awareness to understand the meaning of events)?

	Prior Experience	OIF Experience
Difficult, not frequently		
Somewhat frequently		
Frequently		
Almost always		
Always		

42. To what extent did you collaborate with others while obtaining situational awareness?

	Prior Experience	OIF Experience
Difficult, not frequently		
Somewhat frequently		
Frequently		
Almost always		
Always		

43. To what extent did this shared situational awareness impact on the timing and tempo of operations?

	Prior Experience	OIF Experience
Not frequently		
Somewhat frequently		
Frequently		
Almost always		
Always		

44. How would you rate the extent of your joint forces experience?

Using a scale of 0-5 (where 0 = none and 5 = a great deal of experience)

Prior experience level

OIF experience

## **FINAL QUESTION**

What recommendations would you make for the future fielding and employment of information capabilities in terms of doctrine, organization, leader development, and training?

# Appendix F

## *Officer Interview Questionnaire*

### **Questionnaire (V6)**

This interview is to support the U.S. Department of Defense, Office of Force Transformation research into network centric capabilities. The US Army War College has undertaken the task of assessing the impact of information technologies during the conduct of major combat operations conducted by US V Corps and 3<sup>rd</sup> Infantry Division (Mechanized) as part of Operation Iraqi Freedom (OIF). Our goal is to quantify any improvements in increased agility, decision-making, and synchronization of combat power from the tactical through the operational level of war. The case study we will produce will be used by the academic community, both military and civilian, and focuses on information processes and technologies, their impacts on command and control, and further the development of NCW concepts. The central hypothesis of the study is that a robustly networked force improves information sharing, collaboration, quality of information, and shared situational awareness resulting in significantly increased mission effectiveness.

The interviews and the vignettes derived there from are exceedingly important to our research. You are a subject matter expert (SME) on what information made a difference to you and how you received this information. Your responses will be aggregated with a number of others to identify trends and patterns.

I should caution you that some of the questions might seem repetitive but are designed to help us collect as accurate data as is possible. Please feel free to stop us at any time to ask for clarification of any question.

#### **1. Demographics**

- a. Name
- b. Rank
- c. Unit
- d. Branch/CF
- e. Duty title during OIF
  
- f. Briefly describe the scope of your duties and responsibilities in your duty position.
  
- g. Describe the role of your unit and its objectives during each phase of OIF.
  
- h. Describe the typical way in which decisions (military planning process) were made and operations executed in your unit during pre-deployment training.
  
- i. Describe your role in this process.

- j. Describe the typical way in which decisions (military planning process) were made and operations executed in your unit during OIF.
- k. Describe your role in this process.

## **2. Information Systems**

- a. Prior to your deployment, what type of communications and information collection and/or distribution systems did your unit have and train with?
- b. After you deployed, did your unit receive any new communications and/or information collection and/or distribution systems capabilities?
- c. How were the new systems distributed within your unit?
- d. Who used the new systems?
- e. Did the users of the new systems receive training on the new systems?
- f. Did you or your unit have a plan to use the new systems prior to receiving them?
- g. How did you use the new systems? (e.g., C2, staff coordination, fires, etc.)
- h. What type of information did you receive from the new systems and in what format?
- i. Was the information pushed or pulled?
- j. Did the new systems provide new capabilities? (increased useful information)
- k. Did the new systems allow your unit to conduct missions differently? (e.g., link-ups, passages of lines, synchronization of attacks and/or defense, etc.)
- l. Did the new systems provide greater connectivity than was previously possible?

Worse              Same              Marginally better      Much better    Significantly better

- m. Were the new systems compatible with other existing systems in your unit / organization?

### 3. Degree of Networking

- a. Would you describe the connectivity you had with other units/organizations during combat operations? In other words, how did you receive and send information, to include face-to-face?
  
- b. How did this connectivity with other units/organizations compare to your previous experiences?

Worse              Same    Marginally better    Much better    Significantly better

- c. During combat operations, what information system(s) provided you the greatest reach, in terms of distance?
  
- d. During combat operations, what information system(s) provided you the greatest reach, in terms of the numbers of those who received the information you passed? Did the information reach all of the intended recipients?
  
- e. During combat operations, what information systems provided the greatest reliability? (In terms of reliability of network availability and authenticity)
  
- f. How did this reliability during combat operations compare to your previous experiences?

Worse              Same              Marginally better    Much better    Significantly better

- g. During combat operations, what information system or systems provided your unit/organization with the highest quality of service? (e.g., were able to maintain service over distance, on the move, and during adverse weather conditions)
  
- h. How did this quality of service compare to your previous experiences?

Worse              Same              Marginally better    Much better    Significantly better

- i. What types of information were passed over what systems?
  
- j. Can you provide an assessment as to the reliability of each system used? (0 = never 5 = always)
  - i. System A
  - ii. System B
  - iii. Etc.

- k. How did the reliability of these systems compare with your experiences on systems you used prior to deployment? Did not have these capabilities prior to deployment?

System:

Worse						
Same						
Some better						
Much better						
Significantly better						

- l. Were there any new organizational procedures or practices (SOPs) developed or implemented prior to the conduct of combat operations?
- m. Were any of these changes a direct result of any new information systems?
- n. Were there any new procedures or practices adopted during combat operations as a result of experiences learned during operations?
- o. What system(s) provided the greatest capability in terms of effectiveness in the number of tasks handled and reliability?
- p. Based on the information readily available to you, did the nature of your information requests change? If so, how? Did you ask different questions (at a higher level of awareness)?
- q. As you or your staff became more aware of the available information, were there any changes made to operating procedures? If so, please explain.
- r. Do you have any vignettes that you want to share that illustrate the robustness of any information system or systems that had an impact during combat operations?

#### 4. Quality of Information

- a. Considering your duty position and the operations conducted by your unit, in general what type of information did you need? (prior to deployment and during OIF)
- b. In general, of this information, what type of information did you consider to be most critical to your job? (prior to deployment and during OIF)
- c. How did you receive this critical information? (prior to deployment and during OIF)
- d. Where did the information originate? (in terms of echelon, functional specialized units, etc.)

- e. Did other people also need this information? If yes, who else needed this same information?
- f. How was this information shared?
- g. In general, to what extent did the people actually share this information? (0 = hardly ever..., 5 = usually yes).
- h. What factors most contributed to this sharing of information?
  - i. Technological factors
  - ii. Organizational factors
  - iii. Cultural factors (people's attitudes, values, and beliefs)
- i. Of the information and communication systems you identified above, rate the overall capability of the system (as you used it) to share information. (0 = poor, .... 5 = excellent).
  - i. System A
  - ii. System B
  - iii. Etc.

- 5. Situation Awareness and Understanding.** Situation awareness is defined as an individual's knowledge of the relevant 'who, what, where and when' in the battlespace. Situational understanding occurs when individuals take this awareness and develop an understanding of the meaning, implications and likely outcome that may result.

- a. In general, how important was it for you to have accurate and timely situation awareness?. (0 = not necessary for me to do my job, ..., 5 = extremely important for me to do my job). (pre-deployment and during OIF)

Pre-Deployment	OIF
0	0
1	1
2	2
3	3
4	4
5	5

- b. In general, of the information and communications systems you identified previously, which most helped you to acquire the situation awareness necessary for making decisions? (rank 0 = no influence, ..., 5 = extremely helpful) (pre-deployment and during OIF)
- |                       |            |
|-----------------------|------------|
| <b>Pre-Deployment</b> | <b>OIF</b> |
|-----------------------|------------|

- i. System A
- ii. System B
- iii. etc.

- c. In general, how would you rate the correctness of your situation awareness (meaning that your awareness provided a 'picture' of the battlespace that was consistent with ground truth)? (0 = not correct,..., 5 = very correct). (pre-deployment and during OIF)

<b>Pre-Deployment</b>	<b>OIF</b>
-----------------------	------------

0	0
1	1
2	2
3	3
4	4
5	5

- d. Did you usually become aware of key battlespace elements in time to make the decisions you needed to make? (0 = very often did not have awareness necessary before I needed to make a decision, ..., 5 = almost always had the awareness I needed in time to make decisions)

<b>Pre-Deployment</b>	<b>OIF</b>
-----------------------	------------

0	0
1	1
2	2
3	3
4	4
5	5

- e. In general, did you feel like your awareness of key battlespace elements was complete (meaning that you were aware of everything you needed to be aware of)? (0 = usually incomplete awareness of key elements, ..., 5 = rarely or never incomplete awareness of key elements).(BOS) (pre-deployment and during OIF)

<b>Pre-Deployment</b>	<b>OIF</b>
-----------------------	------------

0	0
1	1
2	2
3	3
4	4
5	5

- f. To what extent did you feel that you had an adequate understanding of the situation (meaning that you felt you had enough information and awareness to understand the meaning of events)? (0 = usually not, ...,5 = usually yes). (pre-deployment and during OIF)

<b>Pre-Deployment</b>	<b>OIF</b>
0	0
1	1
2	2
3	3
4	4
5	5

- g. To what extent did you collaborate with others while obtaining situation awareness? (0 = rarely collaborated, ..., 5 = collaborated most of the time) (pre-deployment and during OIF)

<b>Pre-Deployment</b>	<b>OIF</b>
0	0
1	1
2	2
3	3
4	4
5	5

- h. Describe the way in which this collaboration occurred (person to person, phone, radio, chat, etc.).
- i. How many people did you usually collaborate with and describe their operational relation to you?
- j. To what extent did people that needed to collaborate to obtain situation awareness actually do so? (0 = hardly ever, ...., 5 = usually yes). (pre and during)

<b>Pre-Deployment</b>	<b>OIF</b>
0	0
1	1
2	2
3	3
4	4
5	5

- k. What factors most contributed to this?
- i. Technological factors
  - ii. Organizational factors (chain of command)
  - iii. Cultural factors (people's attitudes values and beliefs)
- l. Of the information and communication systems you identified above, rate the overall capability they provided in terms of collaboration (0 = poor, ..., 5 = excellent).
- i. System A
  - ii. System B
  - iii. Etc.

**6. Decision Making Process/Synchronization**

- a. To what extent did the decision making/planning process in OIF differ from your previous experiences? (0 = not different, ..., 5 = very different). Explain.
  - i. Faster decision-making?
  - ii. Better decisions? (in terms of better outcomes)
- b. What most contributed to the similarities/differences? Explain.
  - i. Technological factors
  - ii. Organizational factors
  - iii. Cultural factors
- c. In general, how difficult was it synchronizing decision making pre-OIF? (0 = very difficult, ..., 5 = not very difficult). Explain.

0	1	2	3	4	5
---	---	---	---	---	---

In general, how difficult was it to synchronize decision making during OIF? (0 = very difficult, ..., 5 = not very difficult). Explain.

# Appendix G

## *Survey Questions*

The following questions refer to your position during Operation Iraqi Freedom (OIF). Please answer the following questions according to that position.

### 1. DEMOGRAPHICS:

A. Rank during OIF:

B. Unit level assigned to during OIF:

C. Type of Unit Assigned To:

D. Branch:

E. Career Field:  Operations or Not yet Career Field designated

F. What is Your Functional Area (If no functional area, please select "N/A - I have not selected a functional area yet"):

G1. Duty Position during major combat operations of OIF (20 Mar 03 to 1 May 03):

G2. Please Identify staff section or other:

H. Was this a MTOE position?

Yes (Skip to question J)

No (Continue with question I)

I. Was your duty position a result of modernization of Battle Command Systems?

Yes

No

J. BOS Element of the unit you were assigned to during OIF:

**2. DUTIES AND RESPONSIBILITIES:**

A. Briefly describe the scope of your duties and responsibilities during the major combat operations phase of OIF (20 March 03 to 1 May 03):

B. Briefly describe the role of your unit during the major combat operations phase of OIF (20 March 03 to 1 May 03):

C. Briefly describe the role of your unit after the major combat operations phase of OIF during the transition to Stability and Support Operations (SASO):

Considering your duty position, responsibilities and the operations conducted by your unit/organization, please answer questions D and F.

D. What type of information did you need? (check all that apply)

- Maneuver (Friendly Forces)
- Intelligence (Enemy Forces)
- Force Protection
- Fires
- Logistics
- Mobility
- Other (Please list):

**E.** What Information had the most Impact on the way you fulfilled your duties (Please list the information and why that information had an Impact)?

**F.** What Information did you need that you weren't provided or did not have access to? (Please explain):

### **3. INFORMATION SYSTEMS:**

A. Using the list of Operational Maneuver Information systems provided below, please identify:

- those systems available to you prior deploying for the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
- those systems available to you during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
- those systems that you received training on.

OPERATIONAL MANEUVER:	Prior to OIF	During OIF	Training
Global Command and Control System (GCCS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Command and Control Personal Computer (C2PC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maneuver Control System (MCS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MCS LITE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information Work Space (IWS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digital Topographic Support System (DTSS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blue Force Tracker (BFT) / FBCB2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Narrow Band Single Channel Tactical Satellite (TACSAT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wide Band Single Channel Tactical Satellite (TACSAT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mobile Subscriber Equipment (MSE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Enhanced Positioning Location and Reporting System (EPLARS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Defence Collaboration Tool Suite (DCTS)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
E-Mail	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

A1. If you selected "Other Collaborative Tools" in the box above, please list what those tools were and how you used those tools (If you did not select "Other Collaborative Tools" above, please continue to Question A2):

For questions A2 to A8, using the list of "Operational Maneuver" Information systems provided in question A. above, during the major combat operations phase of OIF (20 Mar 03 to 1 May 03) which system:

A2. Provided the greatest reach (in distance)?

A3. Provided the least reach (in distance)?

A4. Provided the greatest ability to share information?

A5. Provided the least ability to share information?

A6. Provided the greatest reliability (in network availability and authenticity)?

A7. Provided the least reliability (in network availability and authenticity)?

A8. Provided the highest quality (in maintaining service over distance, on the move, and in adverse weather)?

A9. Provided the lowest quality (in maintaining service over distance, on the move, and in adverse weather)?

A10. Please include any other relevant information regarding the use of Operational Maneuver Information systems during OIF (to include training, other Information systems not listed above, and the fielding of multiple operating systems, etc.):

**3. INFORMATION SYSTEMS (cont.):**

- B. Using the list of Operational Protection Information systems provided below, please identify:
- those systems available to you prior deploying for the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
  - those systems available to you during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
  - those systems that you received training on.

OPERATIONAL PROTECTION:	Prior to OIF	During OIF	Training
Air Defence Systems Integrator (ADS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air and Missile Defence Work Station (AMDWS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Worldwide Origin and Threat System (WOTS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint Warning and Reporting System (JWARN)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For questions B1 to B8, using the list of "Operational Protection" Information systems provided in question B. above, during the major combat operations phase of OIF (20 Mar 03 to 1 May 03) which system:

B1. Provided the greatest reach (in distance)?

B2. Provided the least reach (in distance)?

B3. Provided the greatest ability to share information?

B4. Provided the least ability to share information?

B5. Provided the greatest reliability (in network availability and authenticity)?

B6. Provided the least reliability (in network availability and authenticity)?

B7. Provided the highest quality (in maintaining service over distance, on the move, and in adverse weather)?

B8. Provided the lowest quality (in maintaining service over distance, on the move, and in adverse weather)?

B9. Please include any other relevant information regarding the use of Operational Protection Information systems during OIF (to include training, other information systems not listed above, and the fielding of multiple operating systems, etc.):

- C. Using the list of Operational Fires Information systems provided below, please identify:
- those systems available to you prior deploying for the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
  - those systems available to you during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
  - those systems that you received training on.

OPERATIONAL FIRES:	Prior to OIF	During OIF	Training
Advanced Field Artillery Tactical Data System (AFATDS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automated Deep Operations Coordination System (ADOCS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tactical Airspace Integration System (TAIS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Theater Battle Management Core System (TBMCs)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint Tactical Ground Station (JTAGS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For questions C1 to C8, using the list of "Operational Protection" Information systems provided in question C. above, during the major combat operations phase of OIF (20 Mar 03 to 1 May 03) which system:

C1. Provided the greatest reach (in distance)?

C2. Provided the least reach (in distance)?

C3. Provided the greatest ability to share information?

C4. Provided the least ability to share information?

C5. Provided the greatest reliability (in network availability and authenticity)?

C6. Provided the least reliability (in network availability and authenticity)?

C7. Provided the highest quality (in maintaining service over distance, on the move, and in adverse weather)?

C8. Provided the lowest quality (in maintaining service over distance, on the move, and in adverse weather)?

C9. Please include any other relevant information regarding the use of Operational Fire Information systems during OIF (to include training, other information systems not listed above, and the fielding of multiple operating systems, etc.):

D. Using the list of Operational Intelligence Information systems provided below, please identify:

- those systems available to you prior deploying for the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
- those systems available to you during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
- those systems that you received training on.

OPERATIONAL INTELLIGENCE:	Prior to OIF	During OIF	Training
All Source Analysis System (ASAS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ASAS LITE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intelligence and Operations System (IOS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Forward Area Support Terminal (FAST)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integrated Meteorological System (IMS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint Deployable Intelligence Support System (JDISS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint Surveillance Target Attack Radar System (JSTARS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint STARS Work Station (JSWS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint Tactical Terminal (JTT)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reconnaissance Management System (RMS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TROJAN LITE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TROJAN Special Purpose Integrated Remote Intelligence Terminal (SPIRIT)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D1. If you selected "Higher Headquarters Websites" In the box above, please list what those websites were and how you used those websites (If you did not select "Higher Headquarters Websites" above, please continue to Question D2):

For questions D2 to D8, using the list of "Operational Intelligence" Information systems provided in question D. above, during the major combat operations phase of OIF (20 Mar 03 to 1 May 03) which system:

D2. Provided the greatest reach (in distance)?

D3. Provided the least reach (in distance)?

D4. Provided the greatest ability to share information?

D5. Provided the least ability to share information?

D6. Provided the greatest reliability (in network availability and authenticity)?

D7. Provided the least reliability (in network availability and authenticity)?

D8. Provided the highest quality (in maintaining service over distance, on the move, and in adverse weather)?

D9. Provided the lowest quality (in maintaining service over distance, on the move, and in adverse weather)?

D10. Please include any other relevant information regarding the use of Operational Intelligence Information systems during OIF (to include training, other information systems not listed above, and the fielding of multiple operating systems, etc.):

E. Using the list of Operational Logistics Information systems provided below, please identify:

- those systems available to you prior deploying for the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
- those systems available to you during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).
- those systems that you received training on.

OPERATIONAL LOGISTICS:	Prior to OIF	During OIF	Training
CSS Computer System (CSSCS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Joint Deployment Logistics Module (JDLM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integrated Logistics Applications Program (ILAP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In-Transit Visibility (ITV)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Defense Tracking System (DTRAC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VISTAR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mobile Tracking System (MTS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Army Electronic Product Support (AEPS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Defense Automated Addressing System Center (DAASC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operating and Support Management Information System (OSMIS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Defence Supply Expert System (DSES)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Joint Total Asset Visibility (JTAV)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integrated Road Rail Information System (IRRIS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Global Combat Service Support (GCSS)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

For questions E1 to E8, using the list of "Operational Logistics" information systems provided in question E, above, during the major combat operations phase of OIF (20 Mar 03 to 1 May 03) which system:

E1. Provided the greatest reach (in distance)?

E2. Provided the least reach (in distance)?

E3. Provided the greatest ability to share information?

E4. Provided the least ability to share information?

E5. Provided the greatest reliability (in network availability and authenticity)?

E6. Provided the least reliability (in network availability and authenticity)?

E7. Provided the highest quality (in maintaining service over distance, on the move, and in adverse weather)?

E8. Provided the lowest quality (in maintaining service over distance, on the move, and in adverse weather)?

E9. Please include any other relevant information regarding the use of Operational Logistics information systems during OIF (to include training, other information systems not listed above, and the fielding of multiple operating systems, etc.):



For questions F. and G., we are interested in how information flowed between organizations during the major combat operations phase of OIF (20 Mar 03 to 1 May 03). Multidirectional flow of information is the lateral and vertical flow of information. This includes but is not limited to the movement of information between higher and lower headquarters, subordinate units/organizations, other units/organizations in the same company, battalion, brigade, etc., or other units/organizations that are located adjacent, in front of or behind you that you must coordinate with.

Multidirectional Flow of Information:	Yes	No
F. Did the information systems allow for the multi-directional flow of information?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
G. Did your unit use the information systems in a multi-directional flow capacity?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

H. Please list any comments/challenges/successes you experienced regarding the multidimensional flow of information:



For questions I. and J., we are interested in identifying to what degree information systems were fielded and used during the major combat operations phase of OIF (20 Mar 03 to 1 May 03)

New Information Systems Availability :	Everyone	PLT Level and Above	CO Level and Above	BN Level Command/Staff and Above	BDE Level Command/Staff and Above	DIV Level Command/Staff and Above	CORPs Level Command/Staff and Above	N/A
I. Who received new information systems in your unit?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
J. Who used the new information systems in your unit?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

K. How detailed was your unit's fielding plan for new information systems your unit received for OIF?

- Not detailed - no plan or unaware we were receiving new systems  
 Somewhat - aware of receiving new systems but limited fielding plan  
 Detailed - aware of receiving new systems and adequate fielding plan  
 Very - aware of receiving new systems and substantial fielding plan  
 Extremely - aware of receiving new systems and thorough fielding plan  
 N/A - my unit did not receive new information systems/equipment

L. To what extent do you feel the new systems improved combat operations and enhanced combat effectiveness?

- Not At All  
 Slight Extent  
 Moderate Extent  
 Great Extent  
 Very Great Extent  
 N/A - my unit did not receive new information systems or equipment

For questions M through O: In comparison to Information/communication systems you have used in the past (during previous deployment, CTC rotations (NTC/JRTC/GMTC), and other major training events):

	Significantly Less	Less	About the Same	More	Significantly More	N/A - My unit did not receive new systems/equipment
M. How capable were the new systems?	<input type="checkbox"/>					
N. How much connectivity did the new systems provide?	<input type="checkbox"/>					
O. How compatible were the new systems with other systems?	<input type="checkbox"/>					

P. What Information system did you not have access to during OIF that you wish you had (please explain what that system is and why you wish you had it)?

Q. Please share any other information regarding the Information systems you used during OIF. Comment on any issues regarding degree of fielding, training, compatibility, connectivity, etc.:

**4. QUALITY OF INFORMATION:**

For questions A and B: Compared to your previous experiences (previous deployments/CTC rotations/etc.), during the major combat operations phase of OIF (20 MAR 03 - 1 MAY 03):

Timeliness and Accuracy of Information:	Significantly Less	Less	About the Same	More	Significantly More
A. How timely was the information you received?	<input type="checkbox"/>				
B. How accurate was the information you received?	<input type="checkbox"/>				

For questions C and D: Compared to your previous experiences (previous deployments/CTC rotations/etc.), and based on the timeliness and accuracy of information you received during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03):

Decision Time and Confidence:	Significantly Less	Less	About the Same	More	Significantly More
C. How much time did it take to make decisions?	<input type="checkbox"/>				
D. How much confidence did you have in the decisions that were made?	<input type="checkbox"/>				

For questions E and F: Compared to information systems you have used in the past (during previous deployments/CTC rotations/etc.), during the major combat operations phase of OIF (20 MAR 03 - 1 MAY 03):

Previous/New System Comparison:	Significantly Less	Less	About the Same	More	Significantly More	N/A - My unit did not receive new information systems for OIF
E. How timely was the information received from the new systems?	<input type="checkbox"/>					
F. How accurate was the information received from the new systems?	<input type="checkbox"/>					

For questions G to J., please compare your previous experiences (deployments, CTC rotations, etc.) to your experiences during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).

G. How frequently did the information you received provide an accurate "picture" of the

battlespace?

Previous Experience	During OIF
<input type="checkbox"/> Very Seldom / Never	<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom	<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)	<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often	<input type="checkbox"/> Often
<input type="checkbox"/> Very Often / Always	<input type="checkbox"/> Very Often / Always

H. How frequently did you feel that your awareness of key battlespace operating system (BOS) elements was complete (meaning you were aware of everything you needed to be aware of)?

Previous Experience	During OIF
<input type="checkbox"/> Very Seldom / Never	<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom	<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)	<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often	<input type="checkbox"/> Often
<input type="checkbox"/> Very Often / Always	<input type="checkbox"/> Very Often / Always

I. How frequently did you feel you had an adequate understanding of the situation (meaning you felt you had sufficient information and awareness to understand the meaning of events)?

Previous Experience	During OIF
<input type="checkbox"/> Very Seldom / Never	<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom	<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)	<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often	<input type="checkbox"/> Often
<input type="checkbox"/> Very Often / Always	<input type="checkbox"/> Very Often / Always

J. To what extent did the quantity, quality and timeliness of information provided allow you to modify your planning processes or plans prior to execution?

Previous Experience	During OIF
<input type="checkbox"/> Not At All	<input type="checkbox"/> Not At All
<input type="checkbox"/> Slight Extent	<input type="checkbox"/> Slight Extent
<input type="checkbox"/> Moderate Extent	<input type="checkbox"/> Moderate Extent
<input type="checkbox"/> Great Extent	<input type="checkbox"/> Great Extent
<input type="checkbox"/> Very Great Extent	<input type="checkbox"/> Very Great Extent

K. Please share any experiences or comments you may have with respect to the quality/quantity/timeliness of information.

5. DEGREE OF NETWORKING:

For questions A through C, compared to previous experiences (previous deployments/CTC rotations/etc.), during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03):

Connectivity/Reliability/Quality of Service	Significantly Less	Less	About the Same	More	Significantly More
A. How much connectivity did you have with others?	<input type="checkbox"/>				
B. How would you rate the service quality of information systems?	<input type="checkbox"/>				
C. How reliable were the information systems?	<input type="checkbox"/>				

D. What factors contributed to the degree of reliability in question I above? (check all that apply)

- Environmental (e.g., weather)
- Training
- Equipment Limitations (e.g., distance)
- Degree of Fielding In Unit
- Other

Please Explain:

For questions E. to G., please compare your previous experiences (deployments, CTC rotations, etc.) to your experiences during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).

E. How would you rate the overall quality of service of information systems that you used?

Previous Experiences	During OIF
<input type="checkbox"/> Poor	<input type="checkbox"/> Poor
<input type="checkbox"/> Fair	<input checked="" type="checkbox"/> Fair
<input type="checkbox"/> Good	<input type="checkbox"/> Good
<input type="checkbox"/> Very Good	<input type="checkbox"/> Very Good
<input type="checkbox"/> Excellent	<input type="checkbox"/> Excellent

F. How would you rate the impact of information systems on your ability to share actionable/targetable information?

Previous Experiences	During OIF
<input type="checkbox"/> Extremely Negative	<input type="checkbox"/> Extremely Negative
<input type="checkbox"/> Negative	<input type="checkbox"/> Negative
<input type="checkbox"/> Neutral	<input type="checkbox"/> Neutral

<input type="checkbox"/> Positive	<input type="checkbox"/> Positive
<input type="checkbox"/> Extremely Positive	<input type="checkbox"/> Extremely Positive

G. How would you rate the impact of information systems on your ability to coordinate actions and/or weapon system capabilities?

Previous Experiences	During OIF
<input type="checkbox"/> Extremely Negative	<input type="checkbox"/> Extremely Negative
<input type="checkbox"/> Negative	<input type="checkbox"/> Negative
<input type="checkbox"/> Neutral	<input type="checkbox"/> Neutral
<input type="checkbox"/> Positive	<input type="checkbox"/> Positive
<input type="checkbox"/> Extremely Positive	<input type="checkbox"/> Extremely Positive

H. Please provide any additional remarks regarding Information system networking:

#### I. DEGREE OF INFORMATION SHARE-ABILITY:

For questions A through C: During the major combat operations phase of OIF (20 Mar 03 to 1 May 03), how would you rate the following:

Compatibility/Interaction/Timeliness	Poor	Fair	Good	Very Good	Excellent
A. Compatibility of information systems to share information with other systems	<input type="checkbox"/>				
B. Performance of information systems in allowing interaction with others	<input type="checkbox"/>				
C. Timeliness of information received in providing battlespace awareness	<input type="checkbox"/>				

D. What information or communication system(s) provided the greatest ability to interact with others (Please explain how)?

For questions E. to I., please compare your previous experiences (deployments, CTC rotations, etc.) to your experiences during the major combat operations phase of OIF (20 Mar 03 to 1 May 03).

E. How frequently did the timeliness and accuracy of information allow you to coordinate actions/operations among other units/organizations/services?

Previous Experiences	During OIF
<input type="checkbox"/> Very Seldom / Never	<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom	<input type="checkbox"/> Seldom

<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

F. How frequently did information systems provide situational awareness of key battlespace (BOS) elements in order to allow you to make timely decisions?

## Previous Experiences

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

## During OIF

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

G. How frequently did the quantity, quality, timeliness and ability to share information allow you to take actions to mitigate/minimize risk?

## Previous Experiences

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

## During OIF

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

H. How frequently did the quantity, quality, timeliness and ability to share information allow you to be fully aware of the risk you were accepting?

## Previous Experiences

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

## During OIF

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

I. How frequently did the quantity, quality, timeliness and ability to share information have a positive impact on operational tempo?

## Previous Experiences

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

## During OIF

<input type="checkbox"/> Very Seldom / Never
<input type="checkbox"/> Seldom
<input type="checkbox"/> Sometimes (about half the time)
<input type="checkbox"/> Often
<input checked="" type="checkbox"/> Very Often / Always

I. Please share any other information that you feel is related to network-enabled capabilities that were not addressed in this survey:



Click the "Finish" button if you completed the survey and wish to submit your responses. Your responses will automatically be sent to a database.

Click the "Save" button and "Add to Favorites" to set a bookmark if you wish to save your responses and return to the survey at a later time to modify your answers.

Thank you for taking the time to participate in this survey. Your input is critical in determining the effectiveness of network-enabled capabilities.

If you have any questions regarding this survey or the project in general, please contact LTC Alan Seice at (717) 245-3261 or [alan.seice@osd.osd.osd.army.mil](mailto:alan.seice@osd.osd.osd.army.mil).

# Survey Results

## 1. Background:

- a. The purpose of the survey was to obtain quantitative data to support the following case study goals:
- 1) Determine the impact of networked information systems on combat power
  - 2) Determine the impact on battlefield synchronization
  - 3) Determine the impact on commanders and staffs (i.e., did the systems provide increased speed in planning, coordination, and/or decision making?)
  - 4) Determine the impacts on lethality and survivability
  - 5) Determine the impacts on force agility and versatility
  - 6) Determine the impact on operational tempo
  - 7) Determine logistical impact
  - 8) Determine impact on risk
- b. The survey was predominantly quantitative in nature, but it contained several qualitative questions that permitted the respondents to provide comments. The qualitative questions were used to gain insights on issues that arose during the interviews.

## 2. Demographics:

- a. The survey was approved by ARI and was distributed to 1,875 officers in the grades of O-1 to O-6 on 31 August 2004. Participants were given approximately six weeks to respond to the anonymous survey. On 12 October 2004, the survey was closed with 539 responses. The following tables depict survey participation by rank (Table A), unit level (Table B), battlefield operating system to which the officers were assigned (Table C), branch (Table D), type of unit of assignment (Table E), and duty position (Table F) during the major combat operations phase of OIF:

Rank	Frequency	Percent	Population	
			Frequency	Percent
LT	138	25.6	433	22.4
CPT	258	47.9	1015	52.4
MAJ	95	17.6	281	14.5
LTC	42	7.8	174	9.0
COL	5	.9	33	1.7
Missing Rank	1	.2		
<b>Total</b>	<b>539</b>	<b>100.0</b>	<b>1936</b>	<b>100</b>

**Table A: Rank during OIF**

Unit Level	Frequency	Percent
Company/Detachment and below	173	32.1
Battalion	166	30.8
Brigade	84	15.6
Division	30	5.6
Corps	84	15.6
Missing Unit Level	2	.4
<b>Total</b>	<b>539</b>	<b>100.0</b>

**Table B: Unit level assigned to during OIF**

## Network Centric Warfare Case Study

BOS Element	Frequency	Percent
Command and Control	84	15.6
Maneuver	105	19.5
Fire Support	59	10.9
Air Defense	23	4.3
Intelligence	29	5.4
Mobility/Counter Mobility/ Survivability	46	8.5
Combat Support/Combat Service Support	186	34.5
Missing BOS assignment	7	1.3
Total	539	100.0

**Table C: BOS element of the unit you were assigned to during OIF**

Branch	Frequency	Percent
Air Defense	23	4.3
Adjutant General	4	.7
Armor	53	9.8
Army Medical Specialist	7	1.3
Aviation	43	8.0
Chaplain Corps	14	2.6
Dental Corps	2	.4
Engineer	50	9.3
Field Artillery	66	12.2
Infantry	38	7.1
Medical Corps	10	1.9
Medical Service Corps	18	3.3
Military Intelligence	38	7.1
Military Police	11	2.0
Nurse Corps	9	1.7
Ordnance	30	5.6
Multi Functional Logistian	24	4.5
PSYOPS/Civil Affairs	2	.4
Quartermaster	24	4.5
Signal Corps	44	8.2
Special Forces	3	.6
Staff Judge Advocate Corps	15	2.8
Veterinary Corps	1	.2
Chemical or Transportation Corps	10	1.9
<b>Total</b>	<b>539</b>	<b>100.0</b>

Unit Type	Frequency	Percent
Adjutant General	1	.2
Air Defense Artillery	20	3.7
Armor	46	8.5
Artillery	22	4.1
Aviation	45	8.3
Cavalry – Air	4	.7
Cavalry – Ground	29	5.4
Chemical	3	.6
Engineers	52	9.6
Field Artillery	32	5.9
Forward Support Battalion	17	3.2
Headquarters	70	13.0
Infantry	57	10.6
Medical	30	5.6
Military Intelligence	19	3.5
Military Police	13	2.4
Multifunctional Logistian	20	3.7
Program	10	1.9
Ordnance	5	.9
Quartermaster	27	5.0
Signal Corps	2	.4
Special Forces	15	2.8
Transportation	<b>539</b>	<b>100.0</b>

**Table E: Type of Unit of Assignment****Table D: Branch**

Duty Position	Frequency	Percent
Platoon Leader	76	14.1
Executive Officer	41	7.6
Company/Detachment Commander	78	14.5
Battalion Level Commander	15	2.8
Brigade Level Commander	4	.7
Staff Officer	274	50.8
Other	50	9.3
Missing Duty Position	1	.2
<b>Total</b>	<b>539</b>	<b>100.0</b>

**Table F: Duty Position**

b. Based on the demographics displayed in Table A, we can assume that the respondents for this survey constitute a representative sample of the entire population with respect to rank. Although we did not receive population data for Tables B through F, we will assume that the breakdown of respondents with respect to unit level of assignment, battlefield operating system to which the officers were assigned, branch, type of unit of assignment, and duty position also constitute a representative sample of the entire population for 3ID and V Corps during the major combat operations phase of OIF.

### 3. Analysis.

Analysis for this study is presented in two sections.

- a. Section 1 consists of overall findings.
- b. Section 2 breaks down the data by echelon of command in which the respondents served during the major combat operations phase of OIF.

Note: As appropriate and if necessary, data will be analyzed by battlespace operating system to identify additional insights. All graphs are accompanied by the survey questions, statistical data, and graphs. For section 1, three charts are provided for each question as appropriate. The first chart depicts the overall responses. The next two graphs divide the data into units which did not receive new information systems for OIF and those individuals which did. Findings in this annex are all statistically significant to at least the 95% level of confidence unless otherwise stated. The use of the word significant indicates the finding is statistically significant and a change of at least 10% in the mean of a comparison question. The use of the word moderate indicates the finding is statistically significant and a change of at least 5% but less than 10% in the mean of a comparison question.

**Section 1. A. – Overall Findings:**

1. New information systems moderately improved combat operations and enhanced combat effectiveness.
2. In comparison to information systems used in the past, the new information systems are more capable, provide more connectivity, and are slightly more compatible with other systems.
3. Overall, during the major combat operations phase of OIF, information was somewhat more timely and accurate in comparison to previous experiences. However, individuals that had and used new information systems noted a significant increase in information timeliness and accuracy.
4. Compared to previous experiences, during the major combat operations phase of OIF, timeliness and accuracy of information had a significant impact on speed and confidence in decision making:
  - a. It took less time to make decisions.
  - b. There was more confidence in the decisions.
5. In comparison to prior experiences, the overall service quality of the information systems was about the same; it received a rating just below good. However, those individuals who received new information systems noted a moderate improvement in service quality.
6. Compared to previous experiences, reliability of information systems was rated as “about the same,” and degree of fielding, training, environmental conditions, and equipment limitations all played key roles in the degree of reliability of information systems.
  - a. Degree of fielding - Systems such as blue force tacker (BFT) were only fielded two per company.
  - b. Training – 73% of the respondents that received new information systems equipment reported that their unit had a limited fielding plan (50%) or had no fielding plan and/or was unaware it was receiving new equipment (23%).
  - c. Equipment limitations – Systems were not always compatible with each other; bandwidth limitations.
7. Connectivity was rated as “about the same” in comparison to previous experiences.
8. During the major combat operations phase of OIF, compatibility of information systems to share information with other systems and allowing interaction was rated as fair.

9. Overall, compared to previous experiences, during the major combat operations phase of OIF, information systems had a moderate positive impact on and more frequently provided:

- a. An accurate picture of the battlespace.
- b. Awareness of key battlefield operating systems elements.
- c. An adequate understanding of the situation.
- d. Situational awareness (SA) to battlefield operating system elements that enabled timely decisions.
- e. Additionally, those individuals who had new information systems reported a significant positive impact with respect to having an accurate picture of the battlespace and situational awareness of battlefield operating system elements that enabled timely decisions.

10. Compared to previous experiences, during the major combat operations phase of OIF, the quantity, quality, timeliness, and ability to share information had a moderate positive impact on:

- a. Operational tempo (OPTEMPO).
- b. Enhancing risk mitigation.
- c. Enhancing coordination of actions/operations among units/organizations/services.
- d. The extent of plan modification prior to execution.
- e. Additionally, individuals who had new information systems reported a significant positive impact in the areas of OPTEMPO, risk mitigation, coordination of actions/operations among units/organizations/services, and the extent of plan modification prior to execution, as well as a moderate positive impact on risk awareness.

11. Overall, in comparison to prior experiences, information systems had no impact on the ability to share actionable/targetable information:

- a. “New” information systems had a moderate impact on the ability to share “actionable/targetable” information.
- b. “Legacy” information systems had a significant negative impact on the ability to share “actionable/targetable” information.

12. Overall information systems had a moderate positive impact on the ability to coordinate actions and/or weapon system capabilities during OIF:

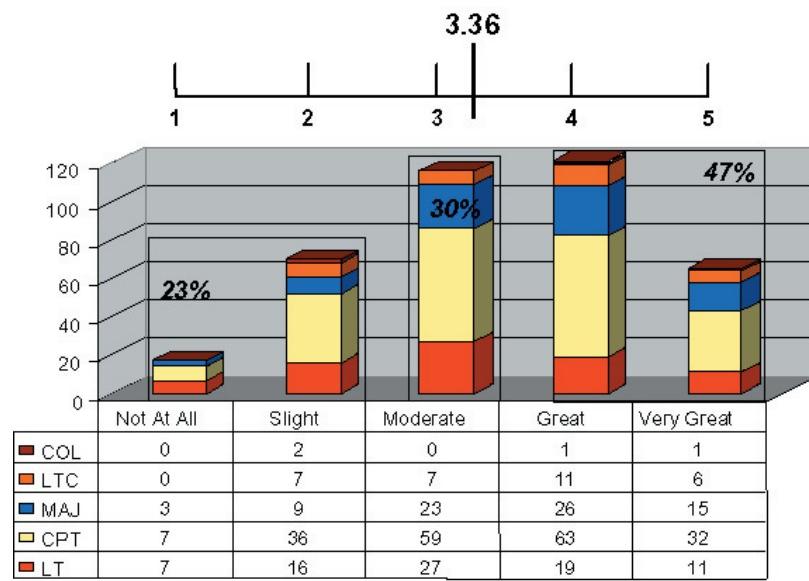
- a. “New” information systems enabled coordination of actions and/or weapon system capabilities to a moderate extent.
- b. “Legacy” information systems had a significant negative impact on coordinating actions and/or weapon system capabilities.

13. Information systems impacted battlefield operating systems (BOS) by varying degrees.
  - a. Command and Control, Fires, and Maneuver experienced positive impacts.
  - b. Mobility/countermobility/survivability and combat support/combat service support experienced negative impacts.
14. Most reported comments on information that individuals wish they had access to but did not:
  - a. Intelligence – Accurate information concerning the location, disposition, size, strength and composition of enemy forces.
  - b. Logistics
    - 1) Location of sustainment, and resupply assets.
    - 2) Detailed information regarding logistical flow to division and below.
    - 3) Class VII and IX resupply
    - 4) Route changes and status of logistics and resupply
  - c. Maneuver
    - 1) Access to blue force tracker and FBCB2
    - 2) Updated information on friendly forces
  - d. Medical
    - 1) Casualty tracking
    - 2) Casualty status
    - 3) Location and procedures for medical resupply

### Section 1. B. – Supporting Data and Graphs

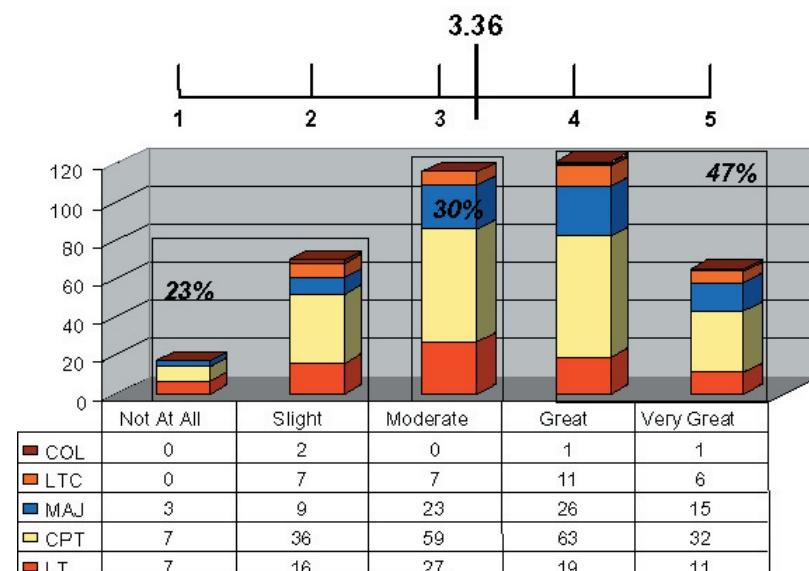
1. To what extent do you feel the new systems improved combat operations and enhanced combat effectiveness?

		Statistic
Responses		388
Mean		3.36
95% Confidence Interval for Mean	Lower Bound	3.25
	Upper Bound	3.47
Median		3.00
Variance		1.214
Std. Deviation		1.102



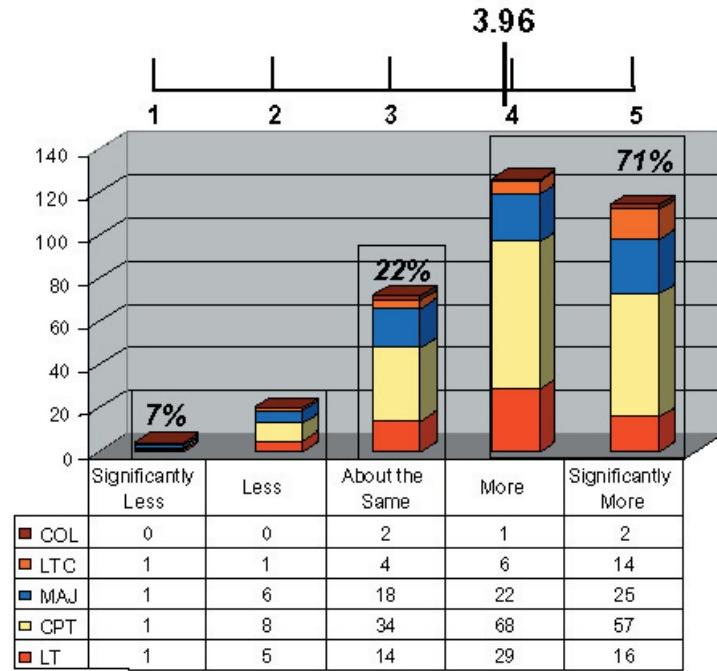
2. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how capable were the new systems?

		Statistic
Responses		346
Mean		4.14
95% Confidence Interval for Mean	Lower Bound	4.04
	Upper Bound	4.23
Median		4.00
Variance		.755
Std. Deviation		.869



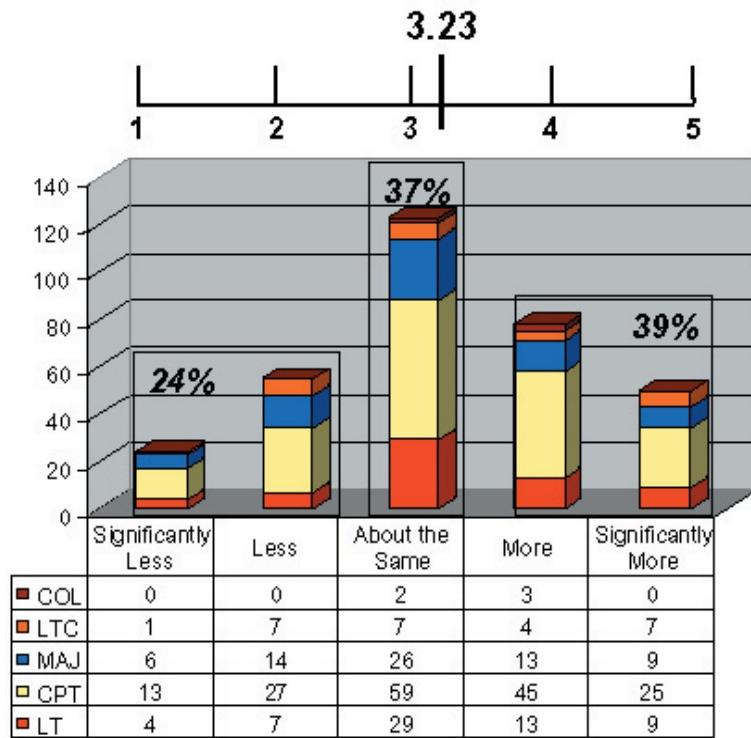
3. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how much connectivity did the new systems provide?

		Statistic
Responses		341
Mean		3.96
95% Confidence Interval for Mean	Lower Bound	3.86
	Upper Bound	4.07
Median		4.00
Variance		.905
Std. Deviation		.951



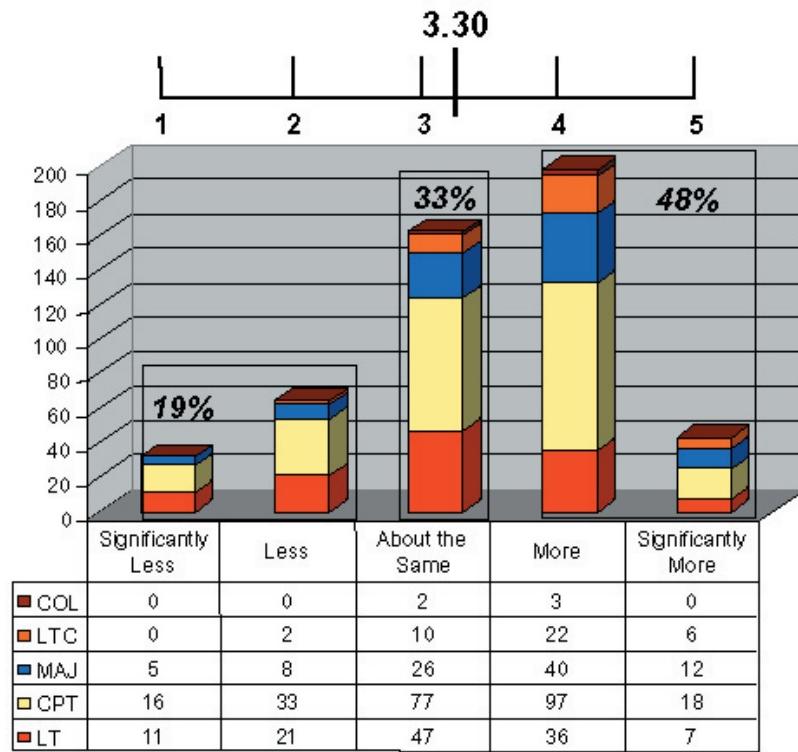
4. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how compatible were the new systems with other systems?

		Statistic
Responses		335
Mean		3.23
95% Confidence Interval for Mean	Lower Bound	3.11
	Upper Bound	3.35
Median		3.00
Variance		1.243
Std. Deviation		1.115



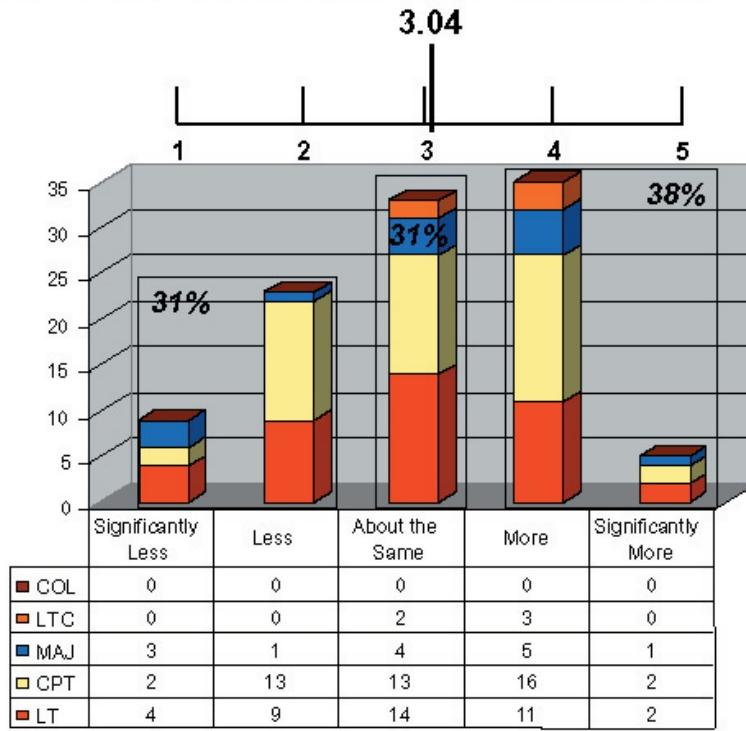
5. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how timely was the information you received (All respondents)?

		Statistic
Responses		499
Mean		3.30
95% Confidence Interval for Mean	Lower Bound	3.20
	Upper Bound	3.39
Median		3.00
Variance		1.050
Std. Deviation		1.025



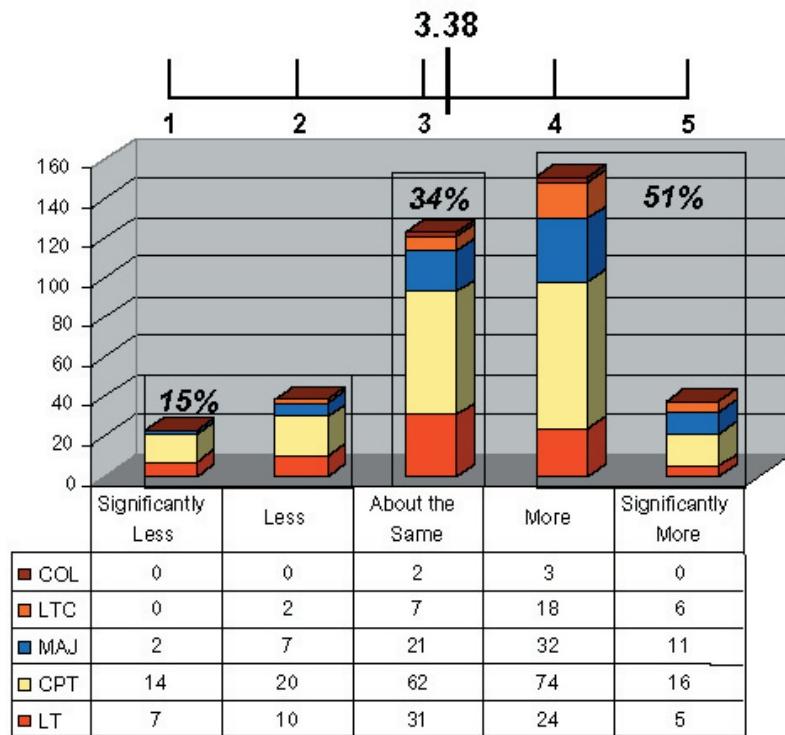
6. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how timely was the information you received (no new systems)?

		Statistic
Responses		105
Mean		3.04
95% Confidence Interval for Mean	Lower Bound	2.84
	Upper Bound	3.24
Median		3.00
Variance		1.095
Std. Deviation		1.046



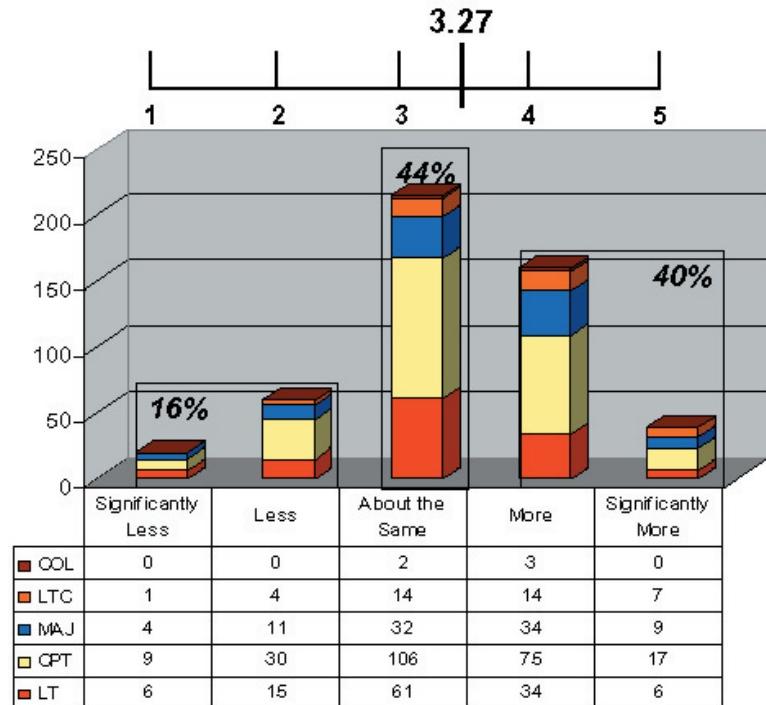
7. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how timely was the information you received (received new systems)?

		Statistic
Responses		374
Mean		3.38
95% Confidence Interval for Mean	Lower Bound	3.28
	Upper Bound	3.48
Median		4.00
Variance		1.017
Std. Deviation		1.008



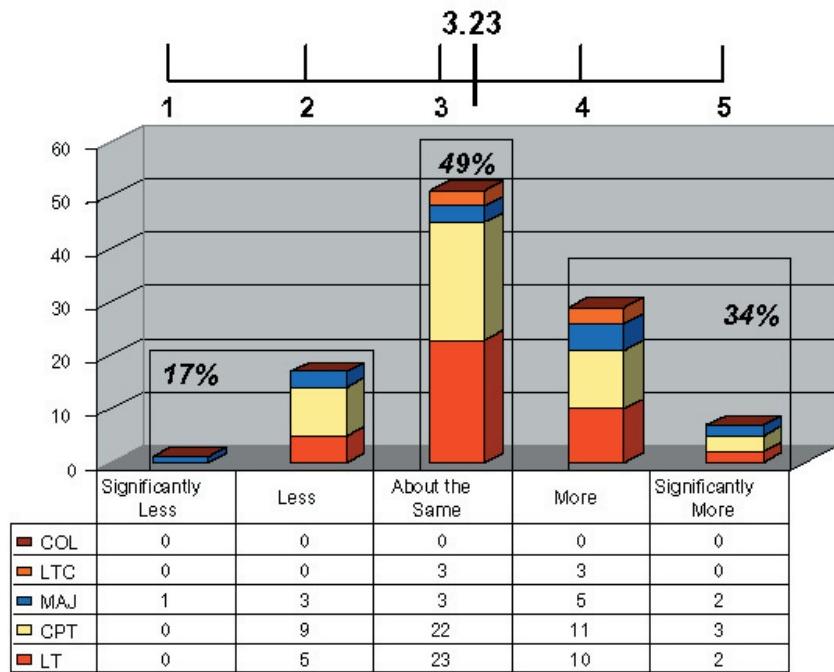
8. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how accurate was the information you received (all respondents)?

		Statistic
Responses		494
Mean		3.27
95% Confidence Interval for Mean	Lower Bound	3.19
	Upper Bound	3.36
Median		3.00
Variance		.862
Std. Deviation		.929



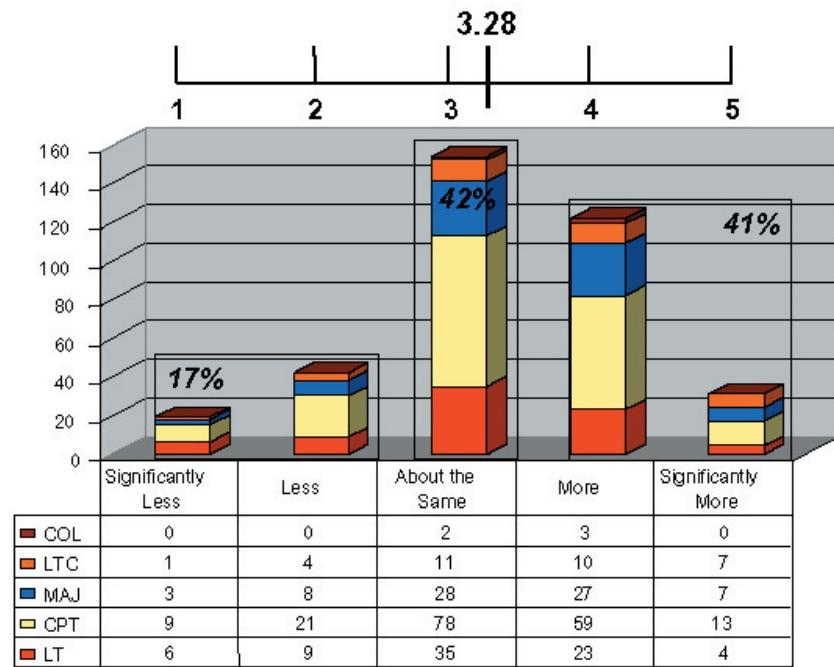
9. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how accurate was the information you received (no new systems)?

		Statistic
Responses		105
Mean		3.23
95% Confidence Interval for Mean	Lower Bound	3.07
	Upper Bound	3.39
Median		3.00
Variance		.697
Std. Deviation		.835



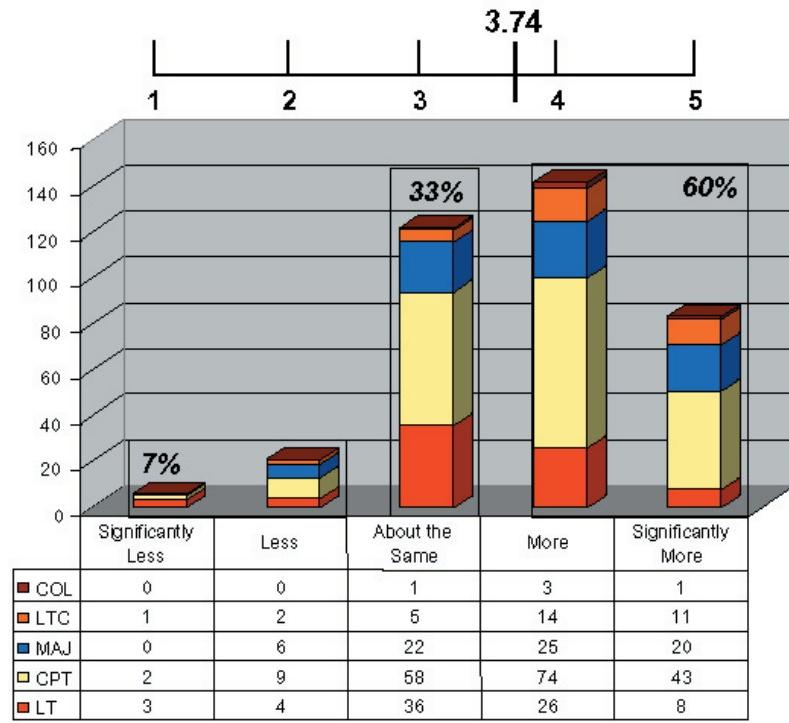
10. In comparison to information/communication systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how accurate was the information you received (received new systems)?

		Statistic
Responses		368
Mean		3.28
95% Confidence Interval for Mean	Lower Bound	3.19
	Upper Bound	3.38
Median		3.00
Variance		.911
Std. Deviation		.954



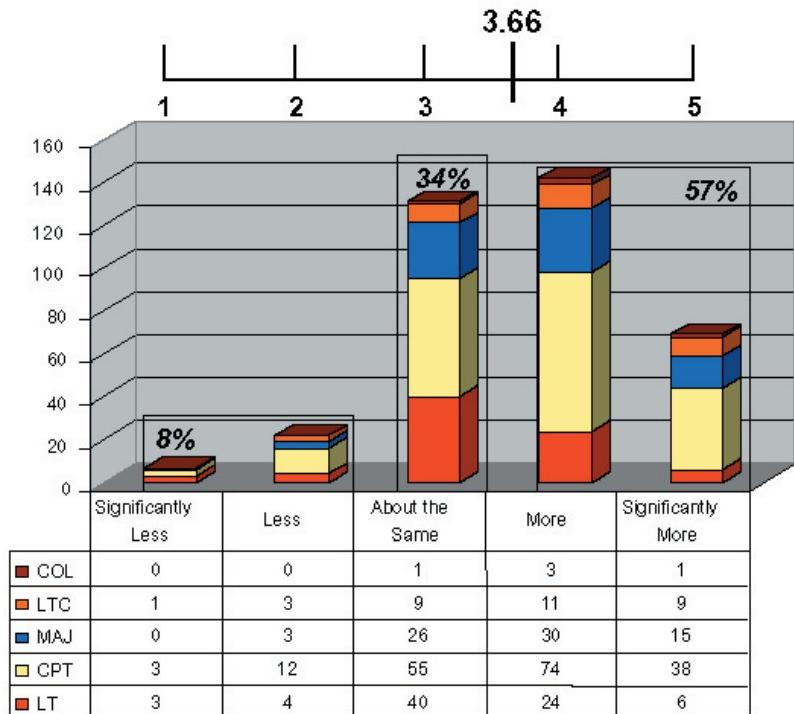
11. Compared to information systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how timely was the information you received from the new systems?

		Statistic
Responses		374
Mean		3.74
95% Confidence Interval for Mean	Lower Bound	3.64
	Upper Bound	3.83
Median		4.00
Variance		.847
Std. Deviation		.920



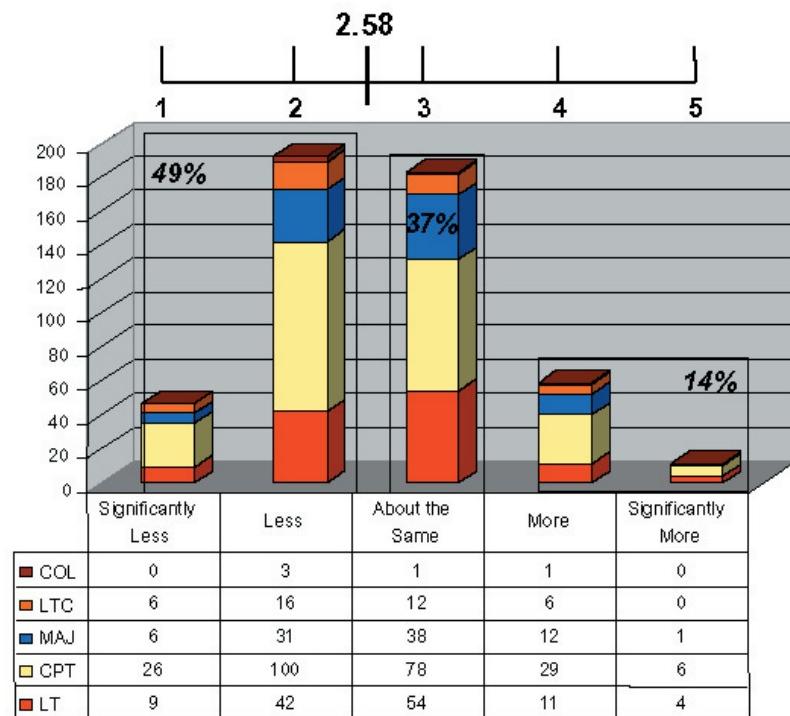
12. Compared to information systems you have used in the past (during previous deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how accurate was the information received from the new systems?

		Statistic
Responses		371
Mean		3.66
95% Confidence Interval for Mean	Lower Bound	3.57
	Upper Bound	3.75
Median		4.00
Variance		.829
Std. Deviation		.911



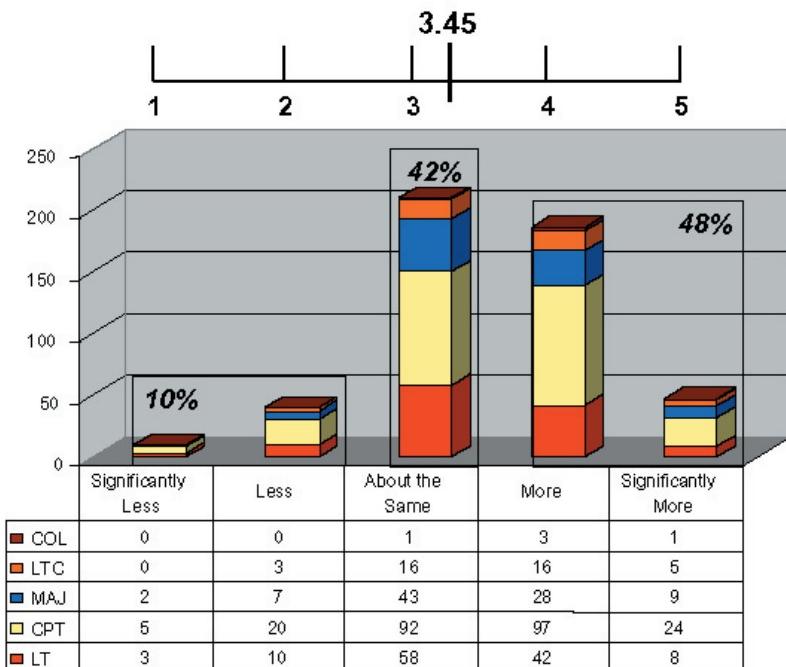
13. Compared to previous experiences (deployments, CTC rotations, etc.), based on the timeliness and accuracy of information you received during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how much time did it take to make decisions?

		Statistic
Responses		492
Mean		2.58
95% Confidence Interval for Mean	Lower Bound	2.50
	Upper Bound	2.66
Median		3.00
Variance		.809
Std. Deviation		.899



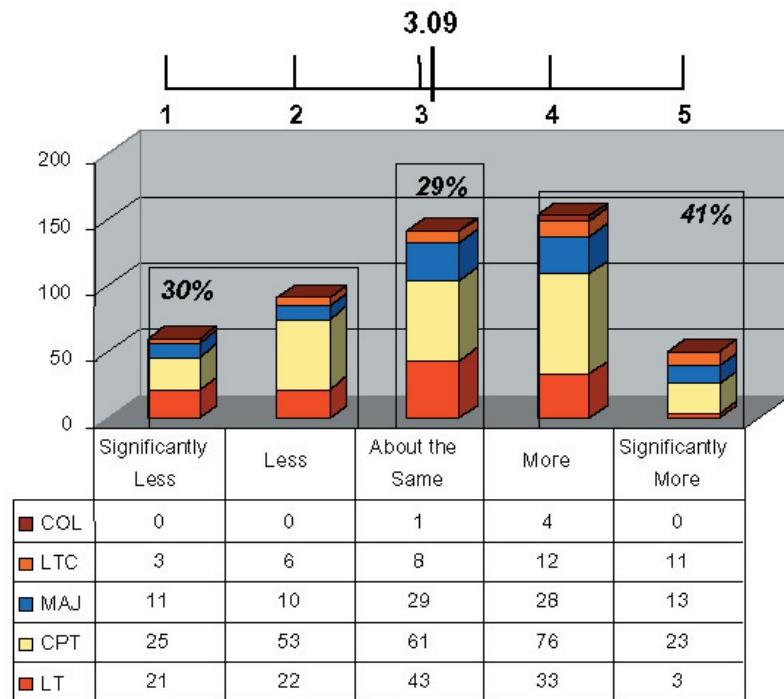
14. Compared to previous experiences (deployments, CTC rotations, etc.), based on the timeliness and accuracy of information you received during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how much confidence did you have in the decisions that were made?

		Statistic
Responses		493
Mean		3.45
95% Confidence Interval for Mean	Lower Bound	3.37
	Upper Bound	3.52
Median		3.00
Variance		.722
Std. Deviation		.850



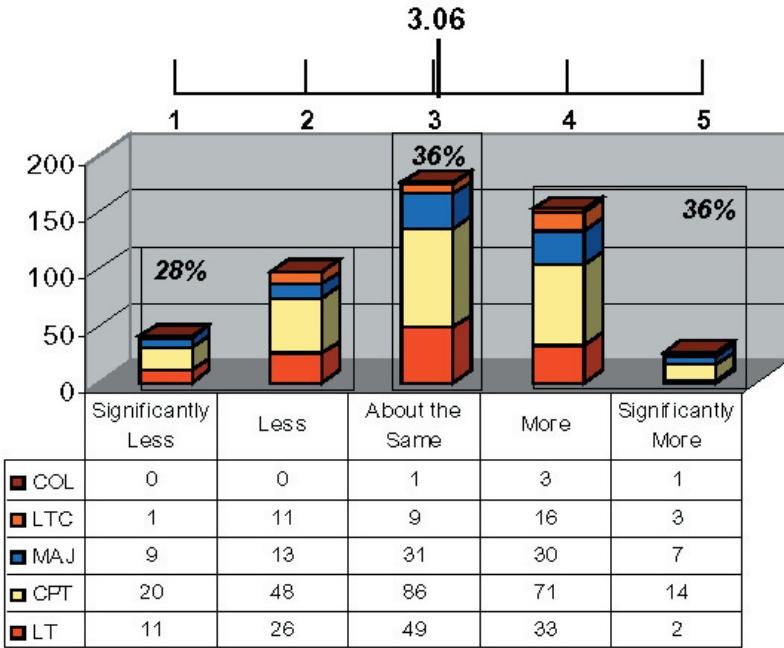
15. Compared to previous experiences (deployments, CTC rotations, etc.), during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how much connectivity did you have with others?

		Statistic
Responses		496
Mean		3.09
95% Confidence Interval for Mean	Lower Bound	2.98
	Upper Bound	3.19
Median		3.00
Variance		1.374
Std. Deviation		1.172



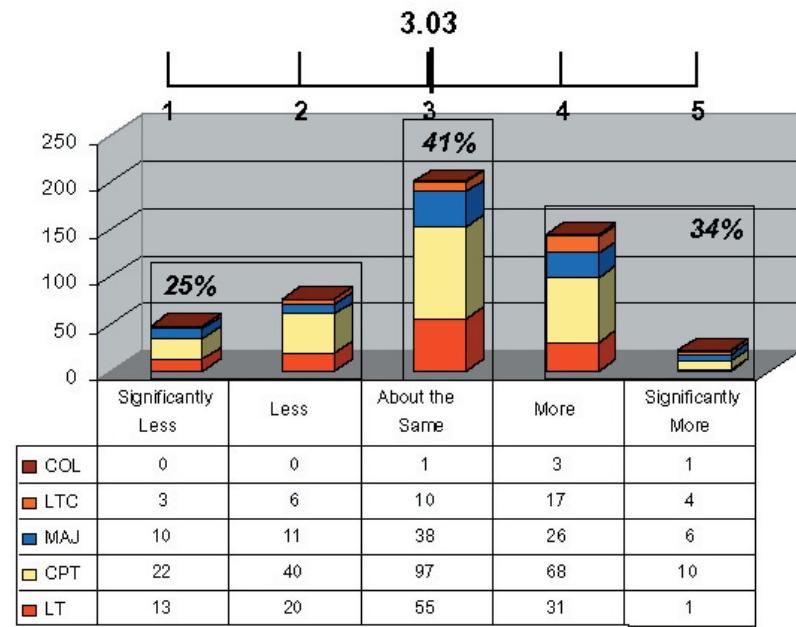
16. Compared to previous experiences (deployments/CTC rotations/etc.), during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the service quality of information systems?

		Statistic
Responses		496
Mean		3.06
95% Confidence Interval for Mean	Lower Bound	2.97
	Upper Bound	3.15
Median		3.00
Variance		1.055
Std. Deviation		1.027



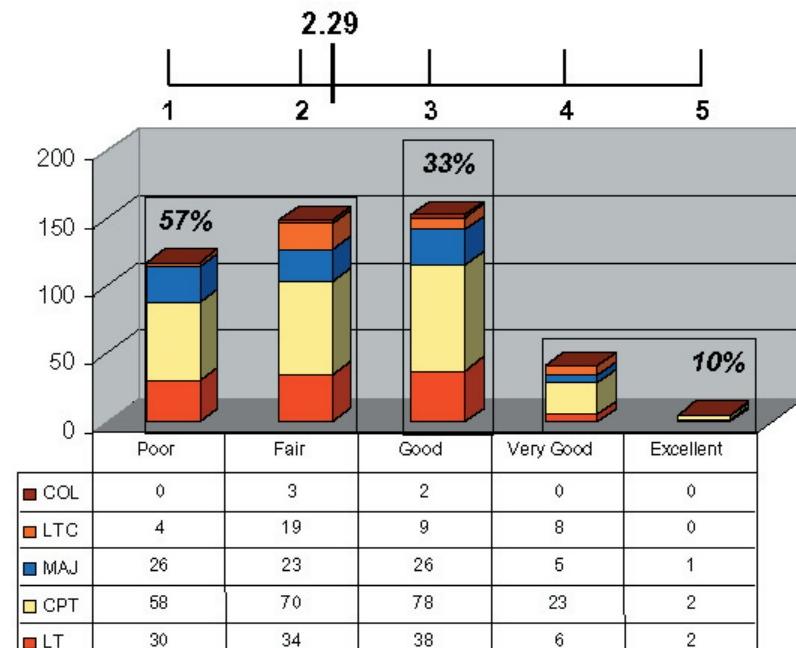
17. Compared to previous experiences (deployments/CTC rotations/etc.), during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how reliable were the information systems?

		Statistic
Responses		493
Mean		3.03
95% Confidence Interval for Mean	Lower Bound	2.95
	Upper Bound	3.12
Median		3.00
Variance		1.019
Std. Deviation		1.010



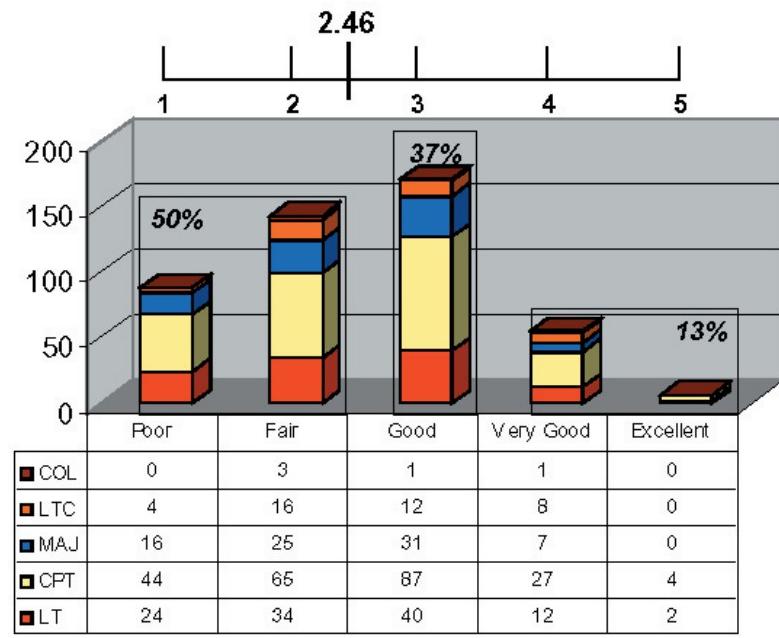
18. During the major combat operations phase of OIF(20 MAR 03 to 1 MAY 03), how would you rate the compatibility of information systems to share information with other systems. Return

		Statistic
Responses		467
Mean		2.29
95% Confidence Interval for Mean	Lower Bound	2.20
	Upper Bound	2.38
Median		2.00
Variance		.955
Std. Deviation		.977



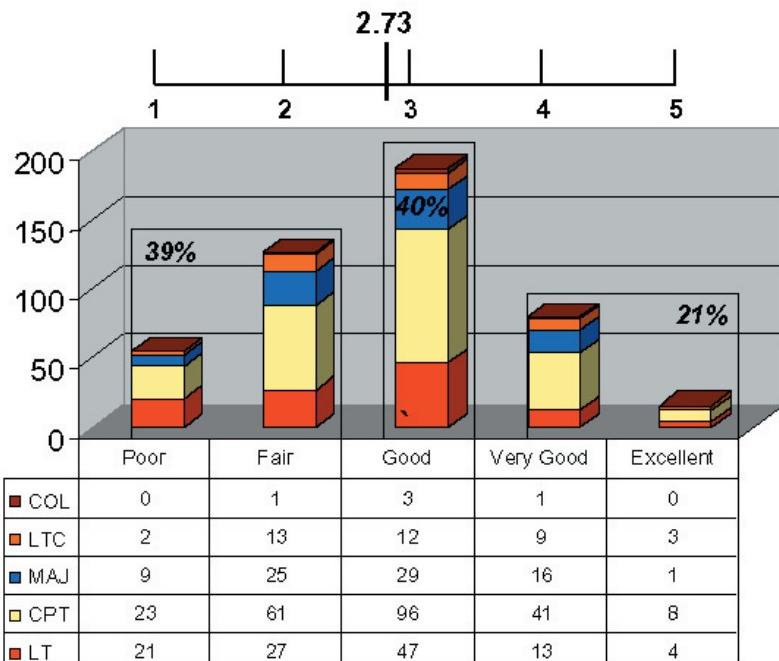
19. During the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the performance of information systems in allowing interaction with others.

		Statistic
Responses		463
Mean		2.46
95% Confidence Interval for Mean	Lower Bound	2.37
	Upper Bound	2.55
Median		3.00
Variance		.944
Std. Deviation		.972



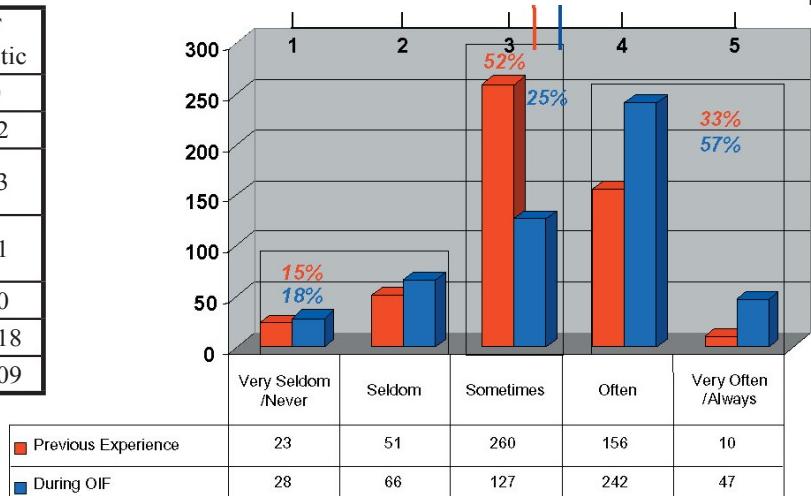
20. During the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the timeliness of information received in providing battlespace awareness?

		Statistic
Responses		465
Mean		2.73
95% Confidence Interval for Mean	Lower Bound	2.64
	Upper Bound	2.82
Median		3.00
Variance		.984
Std. Deviation		.992

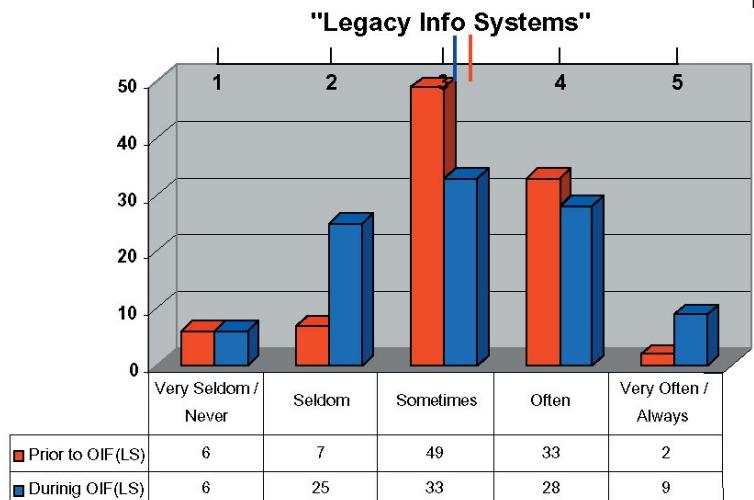


21. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the information you received provide an accurate “picture” of the battlespace?

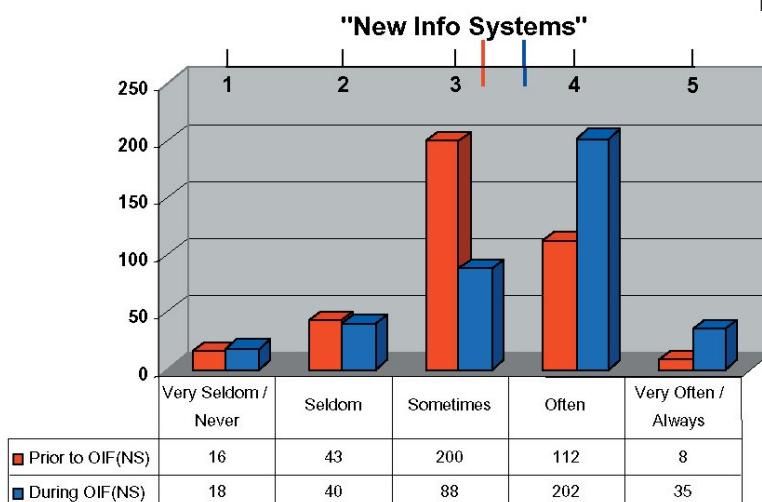
All Respondents		Prior Statistic	OIF Statistic
Responses		500	510
Mean		3.16	3.42
95% Confidence Interval for Mean	Lower Bound	3.09	3.33
	Upper Bound	3.23	3.51
Median		3.00	4.00
Variance		.654	1.018
Std. Deviation		.809	1.009



Legacy Systems		Prior Statistic	OIF Statistic
Responses		97	101
Mean		3.19	3.09
95% Confidence Interval for Mean	Lower Bound	3.02	2.88
	Upper Bound	3.36	3.30
Median		3.00	3.00
Variance		.715	1.122
Std. Deviation		.846	1.059

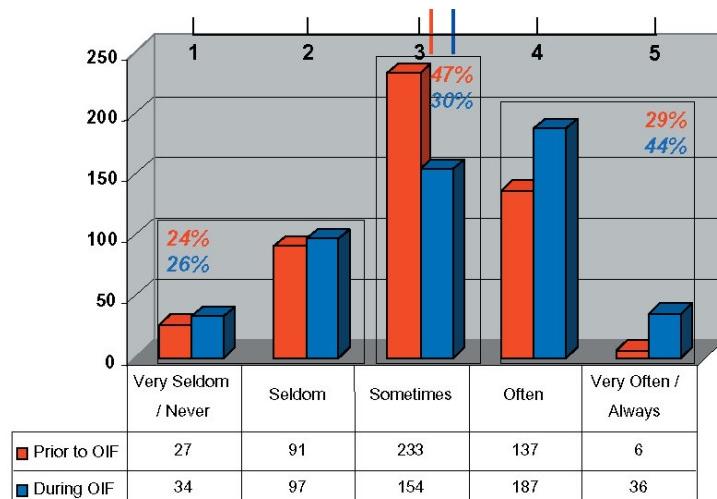


Used New Systems		Prior Statistic	OIF Statistic
Responses		379	383
Mean		3.14	3.51
95% Confidence Interval for Mean	Lower Bound	3.06	3.42
	Upper Bound	3.22	3.61
Median		3.00	4.00
Variance		.643	.924
Std. Deviation		.802	.961

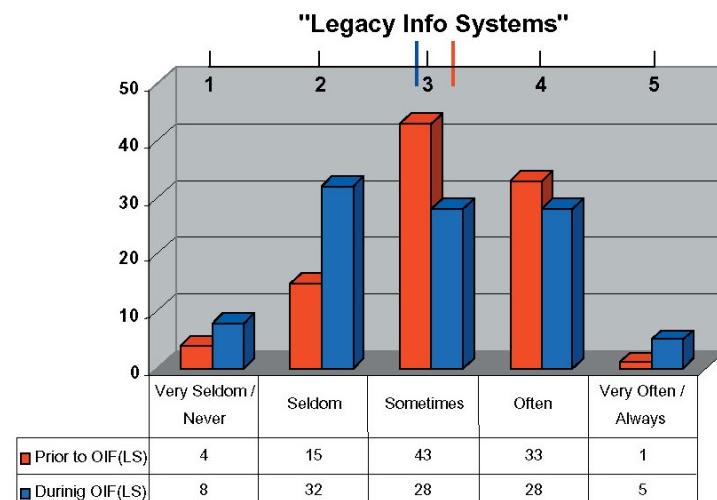


22. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did you feel that your awareness of key battlespace operating system (BOS) elements was complete (meaning you were aware of everything you needed to be aware of)?

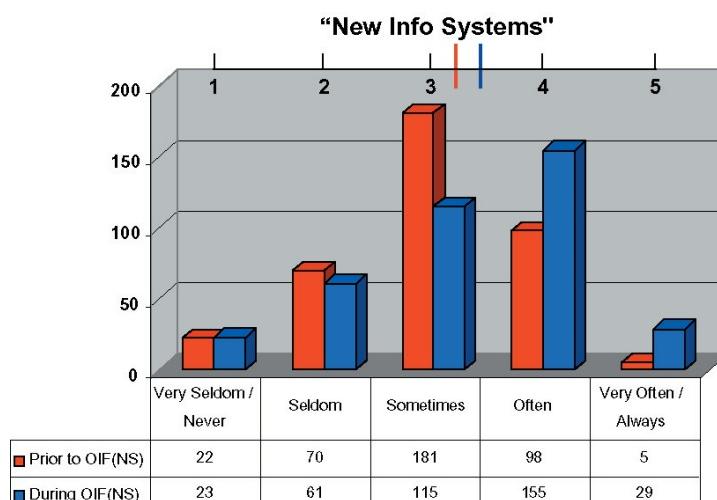
All Respondents		Prior Statistic	OIF Statistic
Responses		494	508
Mean		3.01	3.19
95% Confidence Interval for Mean	Lower Bound	2.93	3.09
	Upper Bound	3.08	3.28
Median		3.00	3.00
Variance		.730	1.078
Std. Deviation		.854	1.038



Legacy Systems		Prior Statistic	OIF Statistic
Responses		96	101
Mean		3.13	2.90
95% Confidence Interval for Mean	Lower Bound	2.96	2.69
	Upper Bound	3.29	3.11
Median		3.00	3.00
Variance		.700	1.11
Std. Deviation		.837	1.054

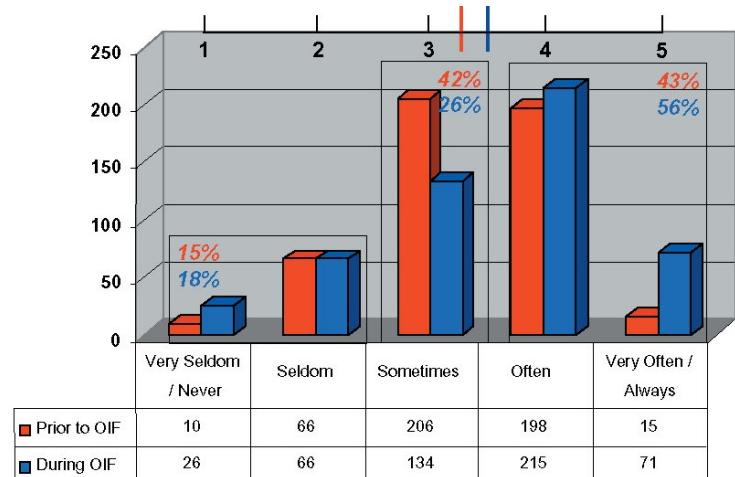


Used New Systems		Prior Statistic	OIF Statistic
Responses		376	383
Mean		2.98	3.28
95% Confidence Interval for Mean	Lower Bound	2.90	3.17
	Upper Bound	3.07	3.38
Median		3.00	3.00
Variance		.734	1.031
Std. Deviation		.857	1.015

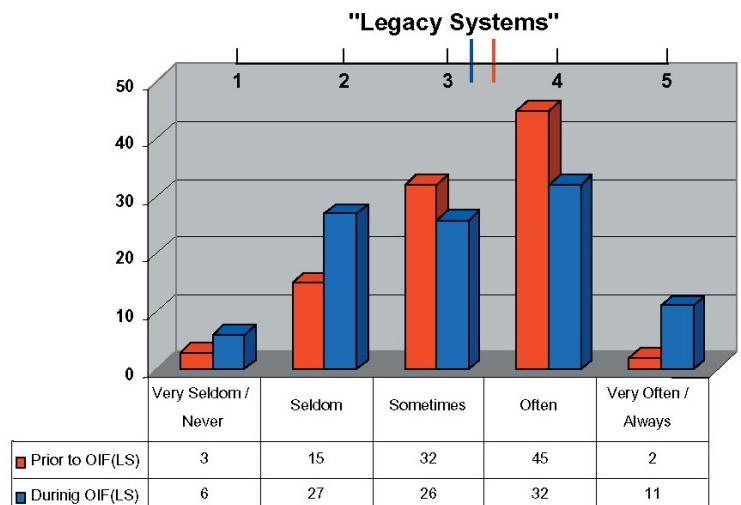


23.. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did you feel you had an adequate understanding of the situation (meaning you felt you had sufficient information and awareness to understand the meaning of events)?

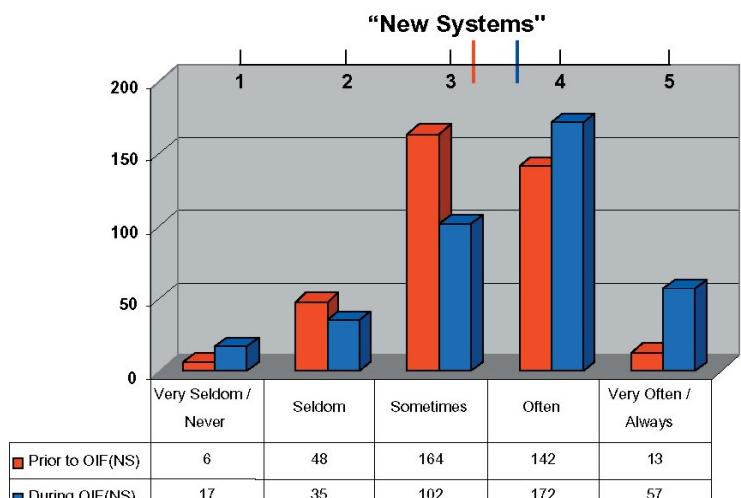
All Respondents		Prior Statistic	OIF Statistic
Responses	495	512	
Mean	3.29	3.47	
95% Confidence Interval for Mean	Lower Bound	3.22	3.38
	Upper Bound	3.36	3.56
Median	3.00	4.00	
Variance	.654	1.091	
Std. Deviation	.809	1.044	



Legacy Systems		Prior Statistic	OIF Statistic
Responses	97	102	
Mean	3.29	3.15	
95% Confidence Interval for Mean	Lower Bound	3.11	2.93
	Upper Bound	3.46	3.37
Median	3.00	3.00	
Variance	.749	1.236	
Std. Deviation	.866	1.112	

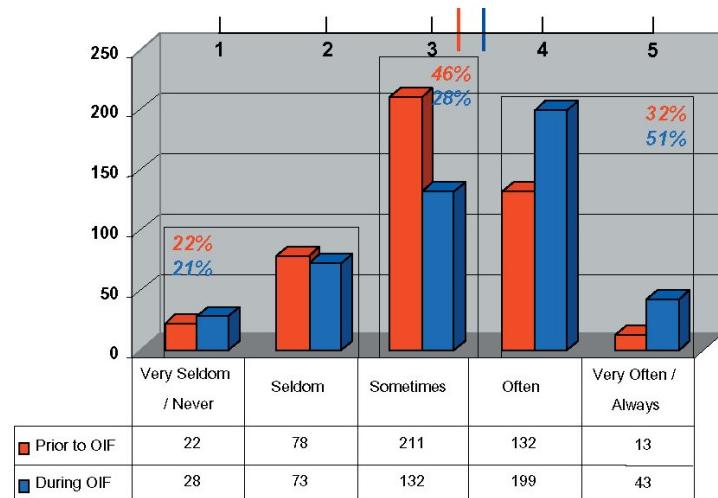


New Systems		Prior Statistic	OIF Statistic
Responses	373	383	
Mean	3.28	3.56	
95% Confidence Interval for Mean	Lower Bound	3.20	2.46
	Upper Bound	3.36	3.66
Median	3.00	4.00	
Variance	.643	.999	
Std. Deviation	.802	.999	

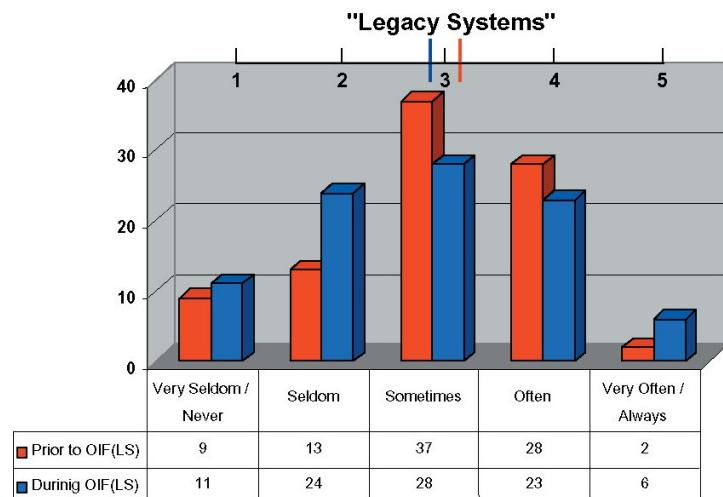


24. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did information systems provide situational awareness of key battlespace (BOS) elements in order to allow you to make timely decisions?

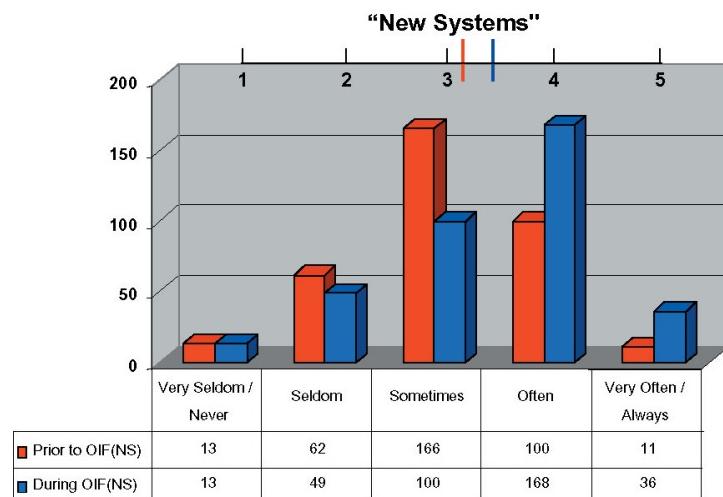
All Respondents		Prior Statistic	OIF Statistic
Mean		3.08	3.33
95% Confidence Interval for Mean	Lower Bound	3.00	3.24
	Upper Bound	3.16	3.42
Median		3.00	4.00
Variance		.763	1.065
Std. Deviation		.873	1.032



Legacy Systems		Prior Statistic	OIF Statistic
Responses		89	92
Mean		3.01	2.88
95% Confidence Interval for Mean	Lower Bound	2.80	2.65
	Upper Bound	3.22	3.11
Median		3.00	3.00
Variance		.966	1.249
Std. Deviation		.983	1.118

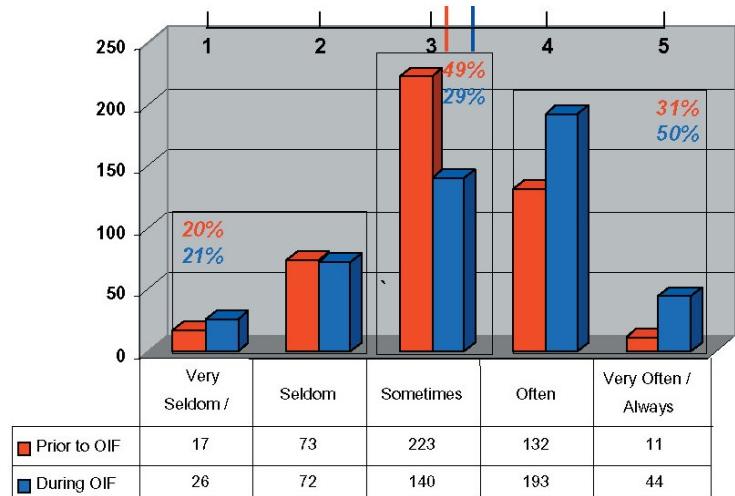


New Systems		Prior Statistic	OIF Statistic
Responses		352	366
Mean		3.10	3.45
95% Confidence Interval for Mean	Lower Bound	3.01	3.35
	Upper Bound	3.19	3.55
Median		3.00	4.00
Variance		.724	.926
Std. Deviation		.851	.962

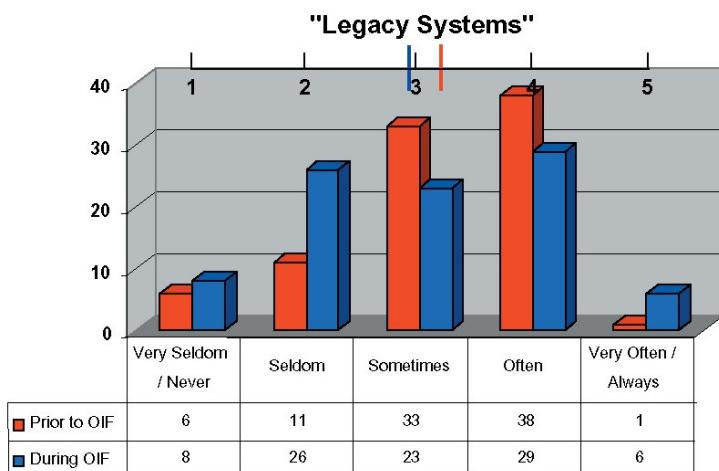


25. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the quantity, quality, timeliness and ability to share information have a positive impact on operational tempo?

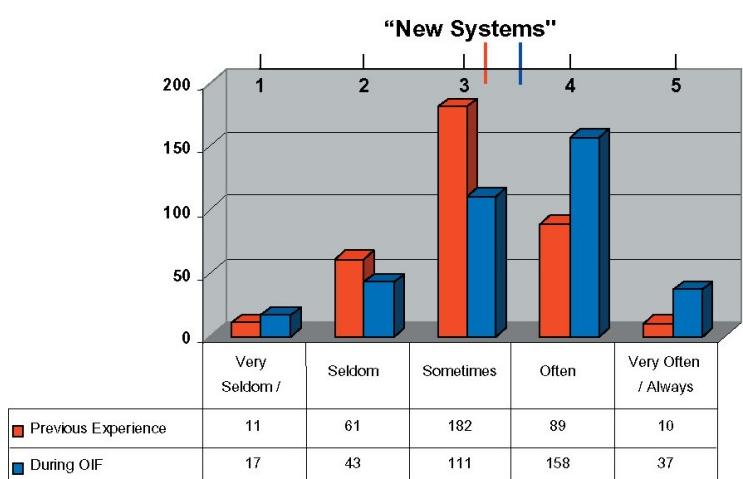
	Prior Statistic	OIF Statistic
Responses	456	475
Mean	3.10	3.33
95% Confidence Interval for Mean	Lower Bound	3.03
	Upper Bound	3.18
Median	3.00	3.00
Variance	.686	1.040
Std. Deviation	.828	1.020



	Prior Statistic	OIF Statistic
Responses	89	92
Mean	3.19	2.99
95% Confidence Interval for Mean	Lower Bound	3.00
	Upper Bound	3.38
Median	3.00	3.00
Variance	.838	1.220
Std. Deviation	.915	1.104

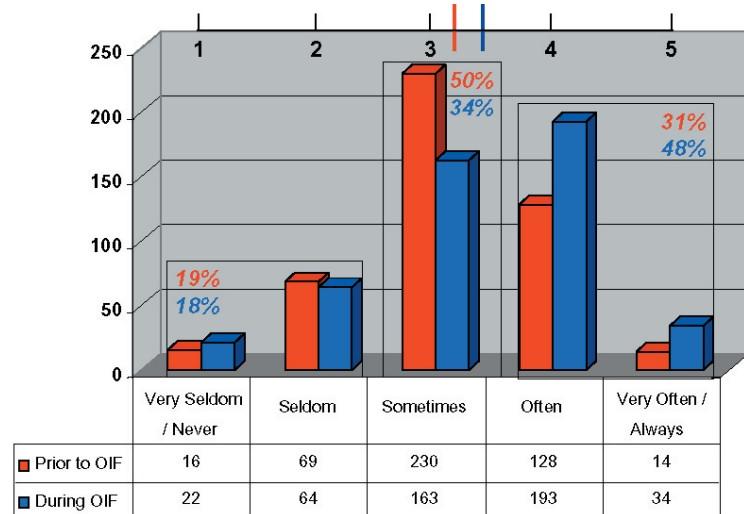


	Prior Statistic	OIF Statistic
Responses	353	366
Mean	3.07	3.42
95% Confidence Interval for Mean	Lower Bound	2.99
	Upper Bound	3.16
Median	3.00	4.00
Variance	.659	.963
Std. Deviation	.812	.981

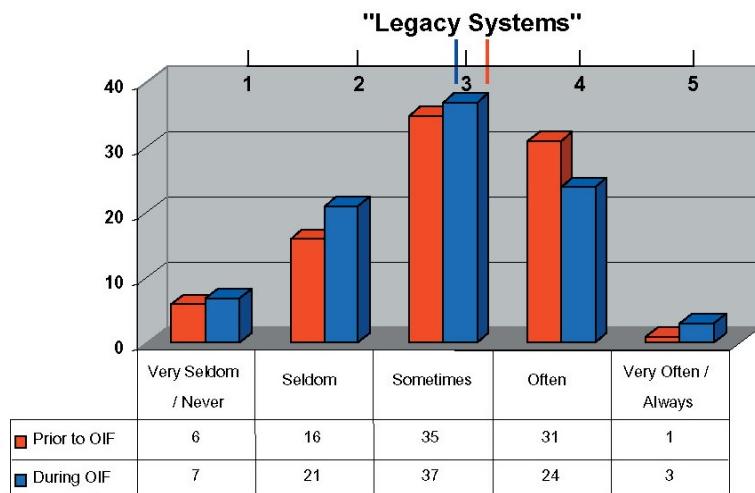


26. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the quantity, quality, timeliness and ability to share information allow you to take actions to mitigate/minimize risk?

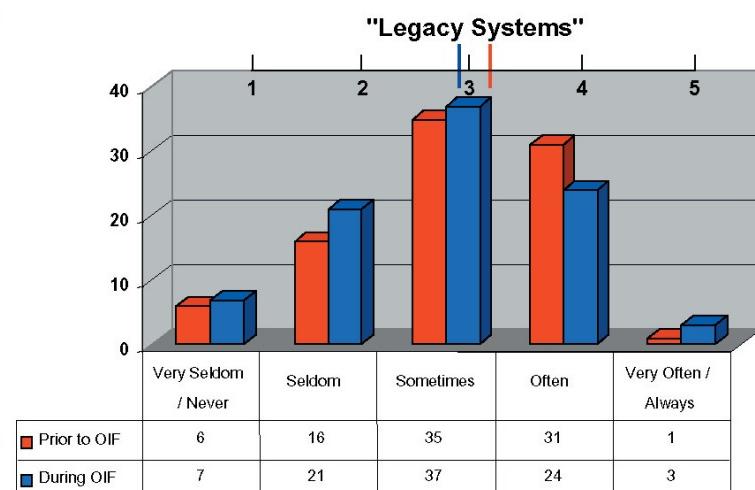
	Prior Statistic	OIF Statistic
Responses	457	476
Mean	3.12	3.32
95% Confidence Interval for Mean	Lower Bound	3.04
	Upper Bound	3.20
Median	3.00	3.00
Variance	.681	.909
Std. Deviation	.825	.953



	Prior Statistic	OIF Statistic
Responses	89	92
Mean	3.06	2.95
95% Confidence Interval for Mean	Lower Bound	2.86
	Upper Bound	3.25
Median	3.00	3.00
Variance	.849	.931
Std. Deviation	.921	.965

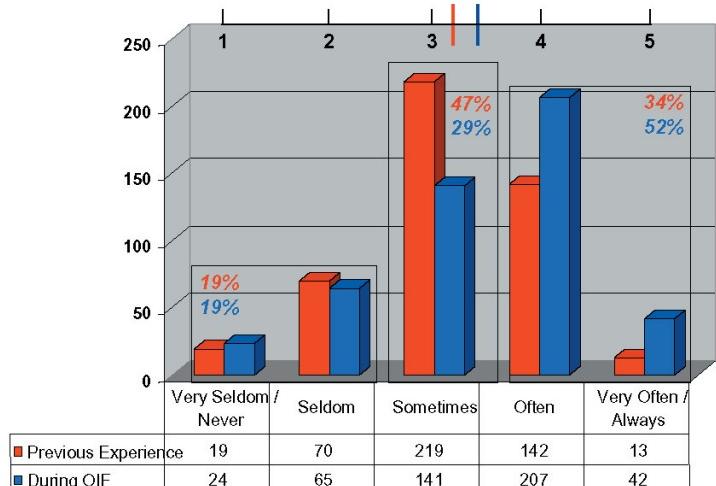


	Prior Statistic	OIF Statistic
Responses	354	366
Mean	3.14	3.42
95% Confidence Interval for Mean	Lower Bound	3.05
	Upper Bound	3.22
Median	3.00	4.00
Variance	.643	.846
Std. Deviation	.802	.920

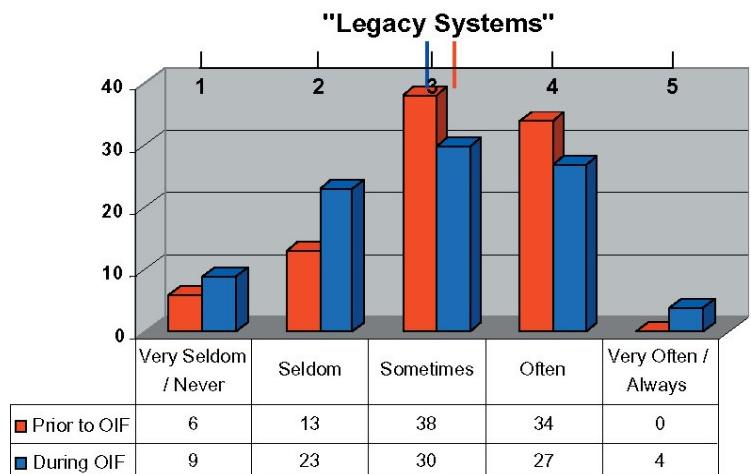


27. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the timeliness and accuracy of information allow you to coordinate actions/operations among other units/organizations/services?

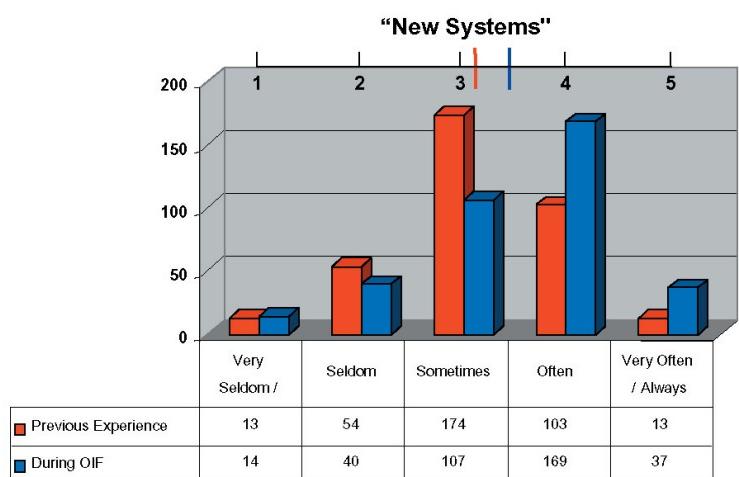
		Prior Statistic	OIF Statistic
Responses		463	479
Mean		3.13	3.37
95% Confidence Interval for Mean	Lower Bound	3.05	3.28
	Upper Bound	3.21	3.46
Median		3.00	4.00
Variance		.719	.983
Std. Deviation		.848	.991



		Prior Statistic	OIF Statistic
Responses		91	93
Mean		3.10	2.94
95% Confidence Interval for Mean	Lower Bound	2.92	2.72
	Upper Bound	3.28	3.15
Median		3.00	3.00
Variance		.779	1.104
Std. Deviation		.883	1.051

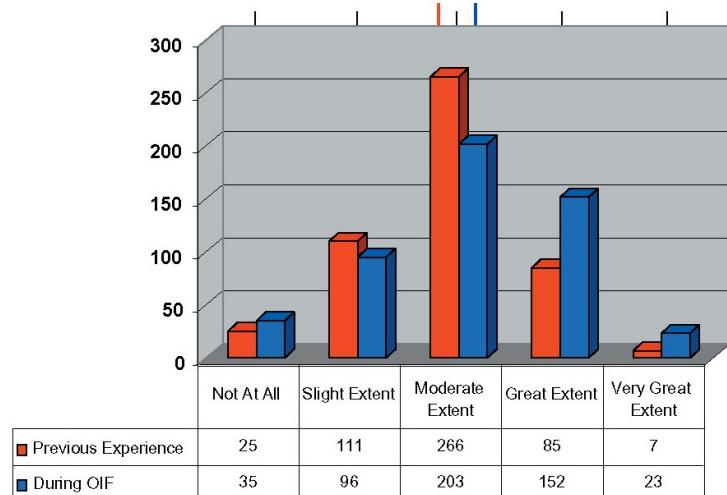


		Prior Statistic	OIF Statistic
Response		357	367
Mean		3.14	3.48
95% Confidence Interval for Mean	Lower Bound	3.05	3.38
	Upper Bound	3.22	3.58
Median		3.00	4.00
Variance		.712	.899
Std. Deviation		.844	.948

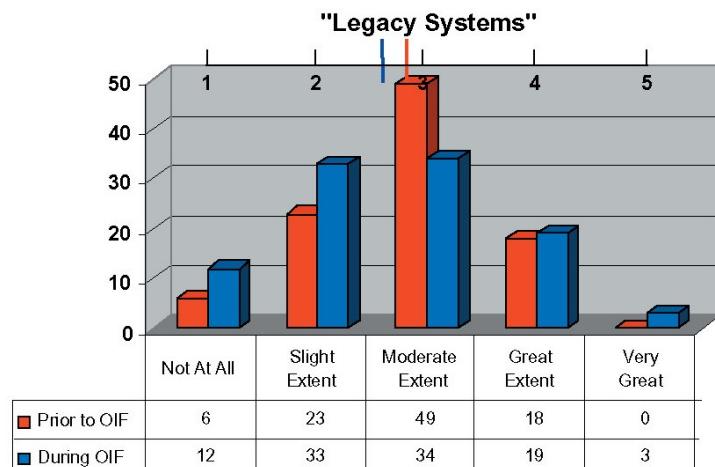


28. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), to what extent did the quantity, quality and timeliness of information provided allow you to modify your planning processes or plans prior to execution?

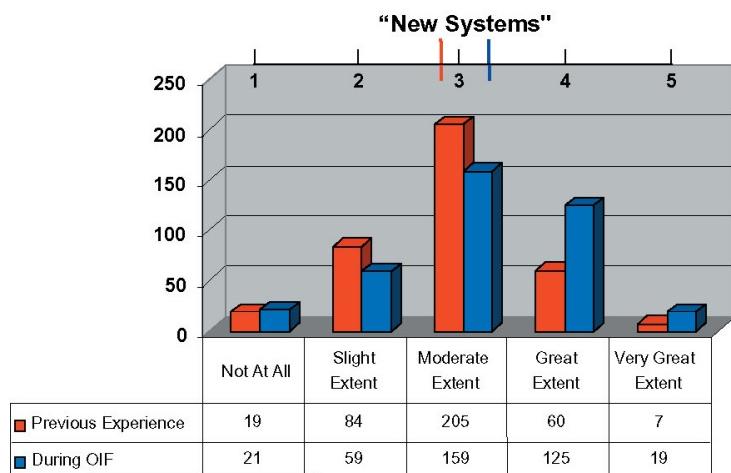
	Prior Statistic	OIF Statistic
Responses	494	509
Mean	2.87	3.06
95% Confidence Interval for Mean	Lower Bound	2.80
	Upper Bound	2.95
Median	3.00	3
Variance	.641	.941
Std. Deviation	.801	.970



	Prior Statistic	OIF Statistic
Responses	96	101
Mean	2.82	2.68
95% Confidence Interval for Mean	Lower Bound	2.66
	Upper Bound	2.99
Median	3.00	3.00
Variance	.653	1.019
Std. Deviation	.808	1.009

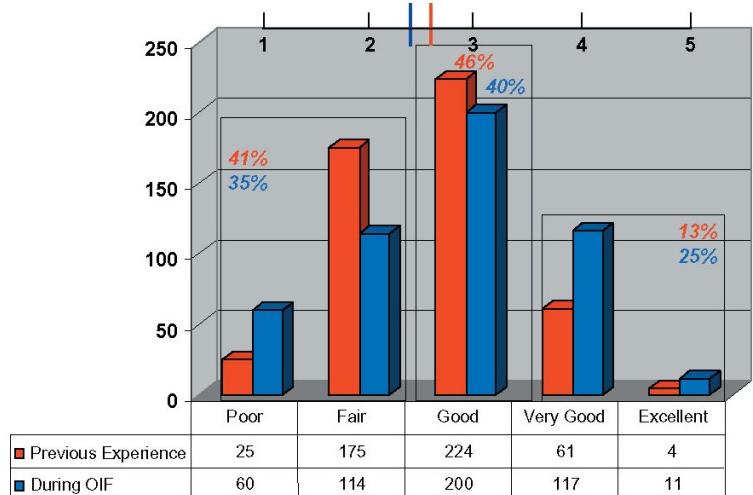


	Prior Statistic	OIF Statistic
Responses	375	383
Mean	2.87	3.16
95% Confidence Interval for Mean	Lower Bound	2.79
	Upper Bound	2.95
Median	3.00	3.00
Variance	.647	.872
Std. Deviation	.804	.934

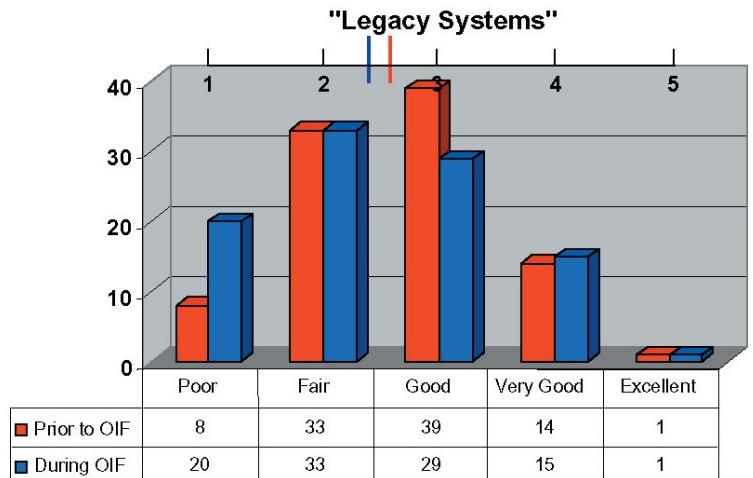


29. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the overall quality of service for information systems that you used?

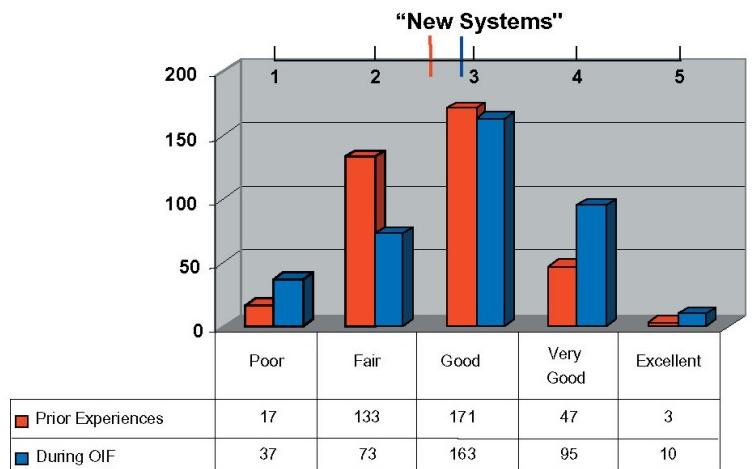
		Prior Statistic	OIF Statistic
Responses		489	502
Mean		2.68	2.81
95% Confidence Interval for Mean	Lower Bound	2.61	2.72
	Upper Bound	2.75	2.90
Median		3.00	3.00
Variance		.619	.992
Std. Deviation		.787	.996



		Prior Statistic	OIF Statistic
Responses		95	98
Mean		2.65	2.43
95% Confidence Interval for Mean	Lower Bound	2.47	2.23
	Upper Bound	2.83	2.63
Median		3.00	2.00
Variance		.761	1.031
Std. Deviation		.872	1.015

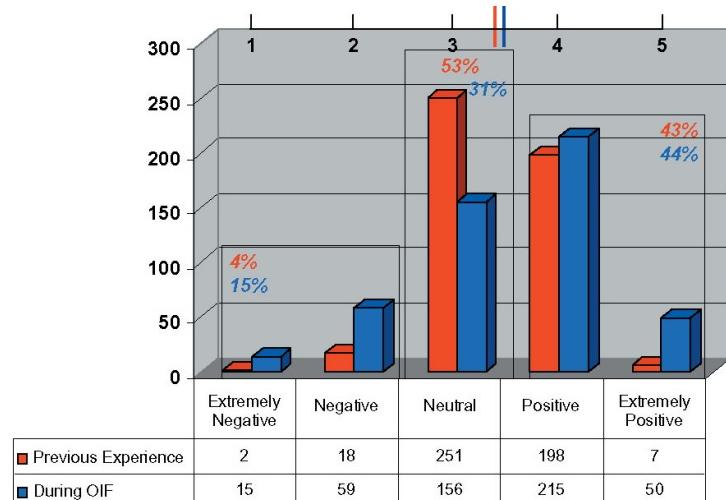


		Prior Statistic	OIF Statistic
Responses		372	379
Mean		2.69	2.92
95% Confidence Interval for Mean	Lower Bound	2.61	2.82
	Upper Bound	2.77	3.01
Median		3.00	3.00
Variance		.608	.935
Std. Deviation		.780	.967

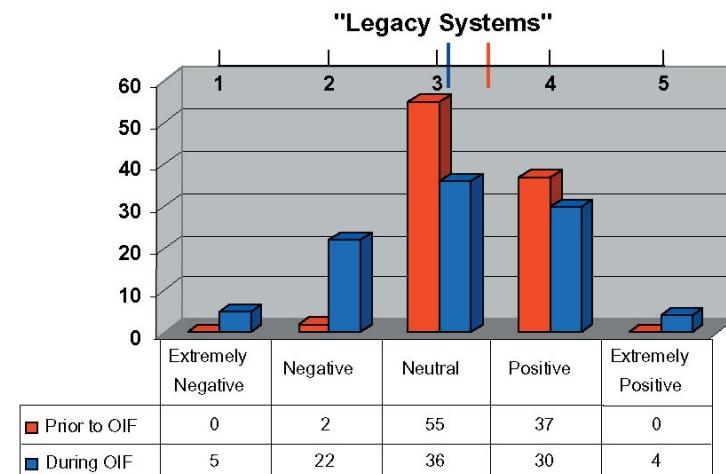


30. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the impact of information systems on your ability to share actionable/targetable information?

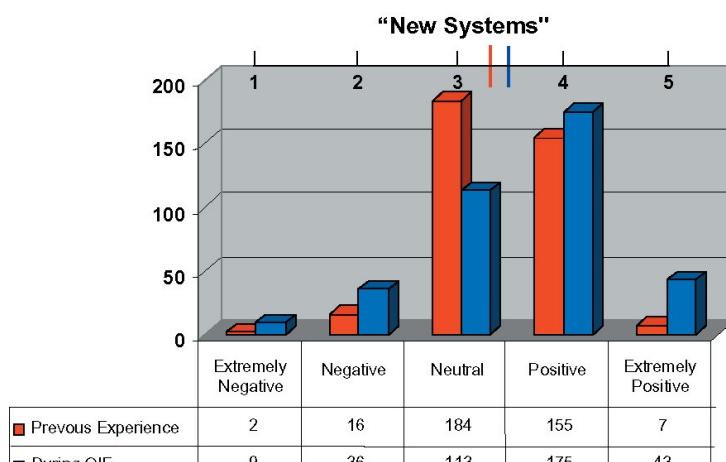
	Prior Statistic	OIF Statistic
Responses	476	495
Mean	3.40	3.46
95% Confidence Interval for Mean	Lower Bound	3.34
	Upper Bound	3.45
Median	3.00	4.00
Variance	.371	.872
Std. Deviation	.609	.934



	Prior Statistic	OIF Statistic
Responses	94	97
Mean	3.37	3.06
95% Confidence Interval for Mean	Lower Bound	3.26
	Upper Bound	3.48
Median	3.00	3.00
Variance	.279	.913
Std. Deviation	.528	.955

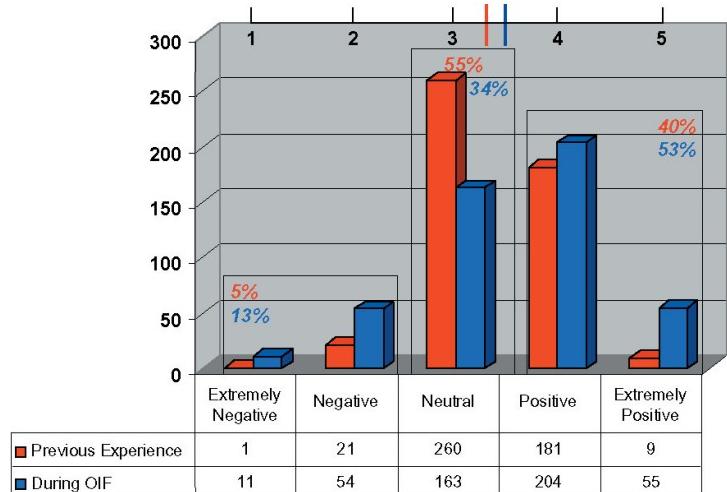


	Prior Statistic	OIF Statistic
Responses	364	376
Mean	3.41	3.55
95% Confidence Interval for Mean	Lower Bound	3.34
	Upper Bound	3.47
Median	3.00	4.00
Variance	.402	.812
Std. Deviation	.634	.901

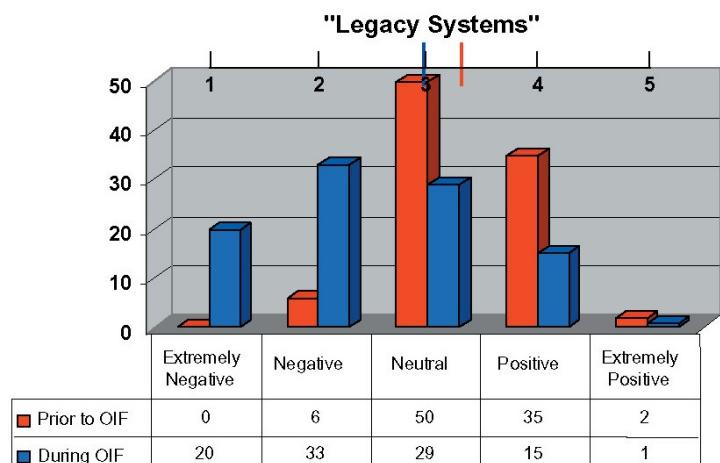


31. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the impact of information systems on your ability to coordinate actions and/or weapon system capabilities?

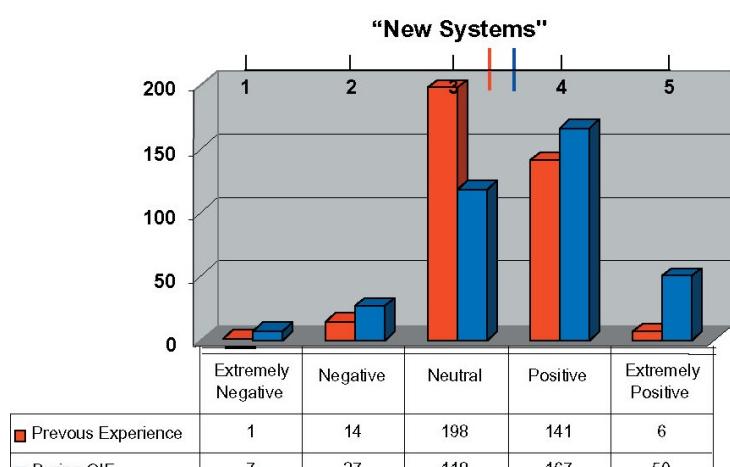
		Prior Statistic	OIF Statistic
Responses		472	487
Mean		3.37	3.49
95% Confidence Interval for Mean	Lower Bound	3.32	3.41
	Upper Bound	3.43	3.57
Median		3.00	4.00
Variance		.374	.835
Std. Deviation		.612	.914



		Prior Statistic	OIF Statistic
Responses		93	96
Mean		3.35	3.01
95% Confidence Interval for Mean	Lower Bound	3.22	2.82
	Upper Bound	3.49	3.20
Median		3.00	3.00
Variance		.405	.853
Std. Deviation		.637	.923



		Prior Statistic	OIF Statistic
Responses		360	369
Mean		3.38	3.61
95% Confidence Interval for Mean	Lower Bound	3.32	3.52
	Upper Bound	3.44	3.70
Median		3.00	4
Variance		.364	.769
Std. Deviation		.603	.877

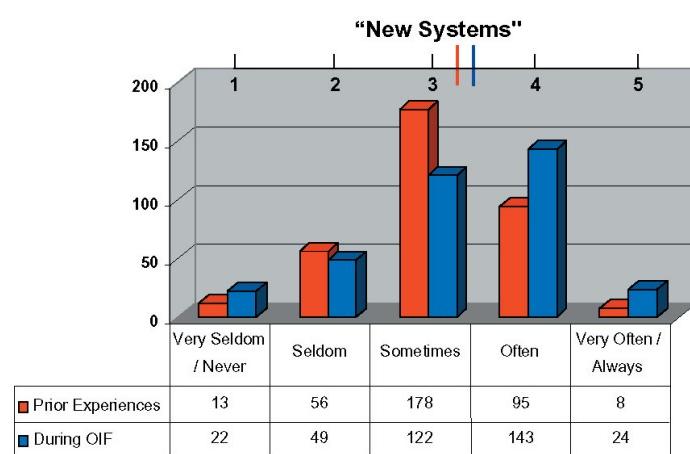
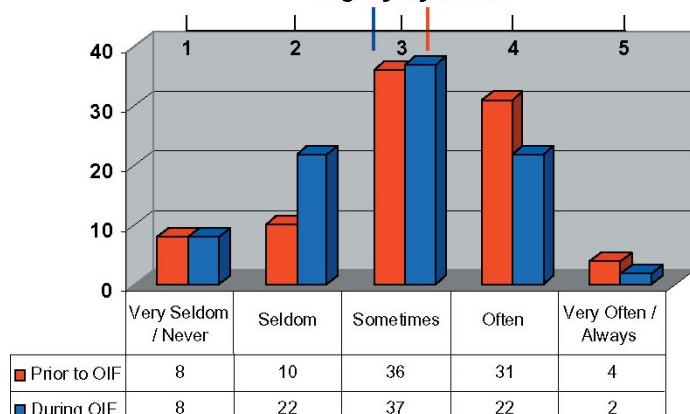
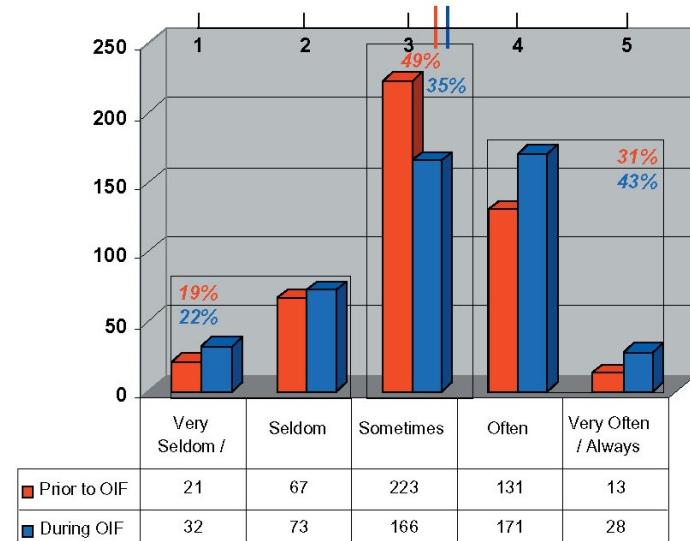


32. Comparing previous experiences (deployments, CTC rotations, etc.) to experiences during the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the quantity, quality, timeliness and ability to share information allow you to be fully aware of the risk you were accepting?

	Prior Statistic	OIF Statistic
Responses	455	470
Mean	3.11	3.19
95% Confidence Interval for Mean	Lower Bound	3.03
	Upper Bound	3.18
Median	3.00	3.00
Variance	.725	.995
Std. Deviation	.851	.998

	Prior Statistic	OIF Statistic
Responses	89	91
Mean	3.15	2.87
95% Confidence Interval for Mean	Lower Bound	2.94
	Upper Bound	3.36
Median	3.00	3.00
Variance	.990	.916
Std. Deviation	.995	.957

	Prior Statistic	OIF Statistic
Responses	350	360
Mean	3.08	3.27
95% Confidence Interval for Mean	Lower Bound	3.00
	Upper Bound	3.17
Median	3.00	3.00
Variance	.665	.972
Std. Deviation	.815	.986



33. What factors contributed to the degree of reliability in question I above? (check all that apply)

	Frequency	Percent
Environmental (e.g., weather)	289	53.62%
Training	206	38.22%
Equipment limitations	323	59.93%
Degree of fielding	261	48.42%
Other	58	10.76%
<b>Total</b>	<b>539</b>	

34. How detailed was your unit's plan for fielding new information systems that your unit received for OIF?

	Frequency	Percent
Not detailed - no plan or unaware we were receiving new systems	94	22.93%
Somewhat - aware of receiving new systems but limited fielding plan	207	50.49%
Detailed - aware of receiving new systems and adequate fielding plan	67	16.34%
Very - aware of receiving new systems and substantial fielding plan	21	5.12%
Extremely - aware of receiving new systems and thorough fielding plan	21	5.12%
Total Responses of those individuals who received new systems	410	100.00%

## Network Centric Warfare Case Study

	Command & Control	Maneuver	Fire Support	Air Defense	Intelligence	Mobility	CS/CSS	Total
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
How timely was the information you received?	3.46	3.26	3.63	3.59	3.43	3.16	3.14	3.31
How accurate was the information you received?	3.40	3.07	3.41	3.62	3.46	3.25	3.23	3.28
How much connectivity did you have with others?	3.58	3.09	3.34	3.00	3.50	2.55	2.84	3.09
How would you rate the service quality of information systems?	3.30	3.21	3.36	2.95	3.43	2.63	2.81	3.06
How reliable were the information systems.	3.23	3.27	3.32	2.91	3.07	2.72	2.80	3.03
Compatibility of information systems to share information with other systems.	2.39	2.31	2.48	2.43	2.33	2.10	2.19	2.29
Performance of information systems in allowing interaction with others	2.65	2.46	2.65	2.50	2.44	2.23	2.36	2.46
Timeliness of information received in providing battlespace awareness	2.88	2.70	2.98	2.70	2.70	2.64	2.63	2.74
During OIF, how frequently did the quantity, quality, timeliness, and ability to share information have a positive impact on operational tempo?	3.59	3.12	3.62	3.76	3.48	3.00	3.21	3.33
During OIF, how frequently did the information you received provide an accurate "picture" of the battlespace?	3.72	3.28	3.57	3.71	3.69	3.16	3.28	3.42
During OIF, how frequently did you feel that your awareness of key battlespace operating system (BOS) elements was complete?	3.44	3.18	3.45	3.45	3.50	2.98	2.95	3.18
During OIF, how frequently did you feel you had an adequate understanding of the situation?	3.70	3.49	3.68	3.68	3.76	3.47	3.20	3.47
During OIF, how frequently did the timeliness and accuracy of information allow you to coordinate actions/operations among other units/organizations/ services?	3.62	3.27	3.56	3.43	3.78	3.17	3.21	3.37
During OIF, how would you rate the impact of information systems on your ability to share actionable/targetable information?	3.64	3.37	3.73	3.68	3.82	3.09	3.33	3.46
During OIF, how would you rate the impact of information systems on your ability to coordinate actions and/or weapon system capabilities?	3.60	3.50	3.85	3.68	3.64	3.11	3.34	3.49
During OIF, to what extent did the quantity, quality, and timeliness of information provided allow you to modify your planning processes or plans prior to execution?	3.31	2.89	3.33	3.14	3.48	3.00	2.89	3.06
During OIF, how frequently did the quantity, quality, timeliness, and ability to share information allow you to take actions to mitigate/minimize risk?	3.59	3.30	3.45	3.62	3.59	3.05	3.12	3.31
During OIF, how frequently did the quantity, quality, timeliness, and ability to share information allow you to be fully aware of the risk you were accepting?	3.44	3.09	3.40	3.43	3.52	2.98	3.02	3.19
During OIF, how would you rate the overall quality of service for information systems?	3.11	2.91	3.18	2.95	3.07	2.41	2.54	2.81
During OIF, how frequently did information systems provide situational awareness of key battlespace (BOS) elements in order to allow you to make timely decisions?	3.61	3.41	3.53	3.48	3.56	3.15	3.05	3.32

Enhanced performance during OIF within specific BOS and better than total population.

Enhanced performance during OIF within specific BOS

Better than overall population mean.

Worse than overall population mean.

**Section 2. A. - Findings by Level of Command**

1. Across all levels of command, respondents reported that new information systems improved combat operations and enhanced combat effectiveness to at least a moderate extent:
  - a. 23% of respondents rated the extent of enhanced combat effectiveness as either “Not At All” or “Slight.”
  - b. 30% of respondents rated the extent of enhanced combat effectiveness as “Moderate.”
  - c. 47% of respondents rated the extent of enhanced combat effectiveness as either great or very great.
2. Compared to information/communication systems used during previous deployments, CTC rotations and other major training events, across all levels of command, respondents reported that new information systems provided:
  - a. More capability.
    - 1) 5% of respondents reported that the new information systems were “significantly less” or “less” capable than information/communication systems used in the past.
    - 2) 14% of respondents reported that the new information systems provided “about the same” capability than information/communication systems used in the past.
    - 3) 81% of respondents reported that the new information systems provided “more” or “significantly more” capability than information/communication systems used in the past.
  - b. Increased connectivity.
    - 1) 7% of respondents reported that the new information systems provided “significantly less” or “less” connectivity than information/communication systems used in the past.
    - 2) 22% of respondents reported that the new information systems provided “about the same” connectivity than information/communication systems used in the past.
    - 3) 71% of respondents reported that the new information systems provided “more” or “significantly more” connectivity than information/communication systems used in the past.
  - c. Provided as much compatibility.
    - 1) 24% of respondents reported that the new information systems were “significantly less” or “less” capable than information/communication systems used in the past.
    - 2) 37% of respondents reported that the new information systems provided “about the same” capability than information/communication systems used in the past.
    - 3) 29% of respondents reported that the new information systems provided “more” or “significantly more” capability than information/communication systems used in the past.
3. Compared to previous experiences, timeliness and accuracy of information varied by level of command:
  - a. At the company/detachment level and below, information timeliness and accuracy remained “about the same.”

- b. At the battalion level, information was “somewhat more” timely with “about the same” accuracy.
  - c. At the brigade and corps level, information was both “more” timely and more accurate.
  - d. The differences in information timeliness and accuracy across levels of command resulted from inadequate fielding of new information systems at the battalion level and below. Individuals who had access to new systems reported increased information timeliness and accuracy across all levels of command.
    - 1) Approximately 7% of respondents reported that the new information/communication systems provided “significantly less” or “less” timely and accurate information than systems used in the past.
    - 2) Approximately 34% of respondents reported that the new information/communication systems provided “about the same” information timeliness and accuracy than systems used in the past.
    - 3) Approximately 58% of respondents reported that the new information/communication systems provided “more” or “significantly more” timely and accurate information than systems used in the past.<sup>4)</sup>
4. Compared to previous experiences and based on the timeliness and accuracy of information received during the major combat operations phase of OIF, across all levels of command:
- a. It took less time to make decisions.
    - 1) 49% of respondents reported that it took “less” or “significantly less” time to make decisions.
    - 2) 37% of respondents reported that it took “about the same” amount of time to make decisions.
    - 3) 14% of respondents reported that it took “more” or “significantly more” time to make decisions.<sup>4)</sup>
  - b. There was more confidence in the decisions.
    - 1) 10% of respondents reported that they had “less” or “significantly less” confidence in the decisions.
    - 2) 42% of respondents reported that they had “about the same” confidence in the decisions.
    - 3) 47% of respondents reported that they had “more” or “significantly more” confidence in the decisions.
5. Compared to previous experiences, the service quality of information systems during the major combat operations phase was:
- a. “About the same” at the battalion level and below.
    - 1) 33% of respondents at the battalion and below reported “less” or “significantly less” service quality.
    - 2) 36% of respondents at the battalion and below reported “about the same” service quality.

- 3) 31% of respondents at the battalion and below reported “more” or “significantly more” service quality.
- b. “Somewhat better” at the brigade level and above.
- 1) 21% of respondents at the brigade or above reported “less” or “significantly less” service quality.
  - 2) 34% of respondents at the brigade or above reported “about the same” service quality.
  - 3) 45% of respondents at the brigade or above reported “more” or “significantly more” service quality.
6. Compared to previous experiences, the reliability of information systems was “about the same” across all levels of command except the corps which reported “somewhat more” reliability.
- a. 25% of respondents reported information systems were “significantly less” or “less” reliable.
  - b. 41% of respondents reported “about the same” reliability.
  - c. 34% of respondents reported information systems were “more” or “significantly more” reliable.
7. Compared to previous experiences, the connectivity was “about the same” across all levels of command except the corps which reported “more” connectivity.
- a. 30% of respondents reported “significantly less” or “less” connectivity.
  - b. 29% of respondents reported “about the same” connectivity.
  - c. 41% of respondents reported “more” or “significantly more” connectivity.
8. During the major combat operations phase of OIF, across all levels of command:
- a. The compatibility of information systems to share information with other systems was rated as “fair.”
    - 1) 57% of respondents rated compatibility as “poor” or “fair.”
    - 2) 33% of respondents rated compatibility as “good.”
    - 3) 10% of respondents rated compatibility as “very good” or “excellent.”
  - b. The performance of information systems in allowing interactions with others was rated between “fair” and “good.”
    - 1) 50% of respondents rated connectivity as “poor” or “fair.”
    - 2) 37% of respondents rated connectivity as “good.”
    - 3) 13% of respondents rated connectivity as “very good” or “excellent.”
  - c. The timeliness of information received in providing battlespace awareness was rated between “fair” and “good” at the battalion and below, and good at the brigade and above.
    - 1) 39% of respondents rated information timeliness as “poor” or “fair.”

- 2) 40% of respondents rated information timeliness as “good.”
- 3) 21% of respondents rated information timeliness as “very good” or “excellent.”

9. Compared to prior experiences, there was no measurable difference during OIF at the battalion level and below in the following areas:

- a. The frequency in which:
  - 1) Information received provided an accurate “picture” of the battlespace.
  - 2) Awareness of key battlespace operating systems was complete (the individual was aware of everything he needed to be aware of).
  - 3) There was an adequate understanding of the situation (meaning the individual had sufficient information to understand the meaning of events).
  - 4) The timeliness and accuracy of information allowed coordination of actions/operations among other units/services/organizations.
  - 5) The quantity, quality, timeliness and ability to share information allowed individuals to become fully aware of the risk they were accepting.
  - 6) The quantity, quality, timeliness and ability to share information had a positive impact on OPTEMPO.
- b. The impact information systems had on the ability to:
  - 1) Share actionable/targetable information
  - 2) Coordinate actions and/or weapon system capabilities.
- c. The extent to which the quantity, quality, and timeliness of information provided allowed individuals to modify planning processes or plans prior to execution.
- d. Overall quality of service for information systems.
- e. The only areas that experienced a measurable moderate change at the battalion level and below were the frequency in which:
  - 1) The quantity, quality, timeliness and ability to share information allowed individuals to take risk mitigation actions.
  - 2) Information systems provided situational awareness of key battlespace operating systems in order to make timely decisions.

10. Compared to prior experiences, at the brigade level and above, during OIF, there were significant improvements in all of the areas listed in finding 9 with the exceptions of the following areas which showed moderate improvements:

- a. The frequency in which the quantity, quality, timeliness and ability to share information allowed individuals to:
  - 1) Become fully aware of the risk they were accepting.
  - 2) Take risk mitigation actions.
- b. The impact of information systems on the ability for individuals to:

- 1) Share actionable/targetable information.
- 2) Coordinate actions and/or weapon system capabilities.

11. In each of the areas listed in finding 9 above, the results at the brigade level and above were significantly better than at the battalion level and below.

12. Despite the overall level of command findings listed in 9 above certain battlefield operating systems did experience additional measurable impacts due to information systems at the battalion level and below. The tables below depict these results using the following legend:

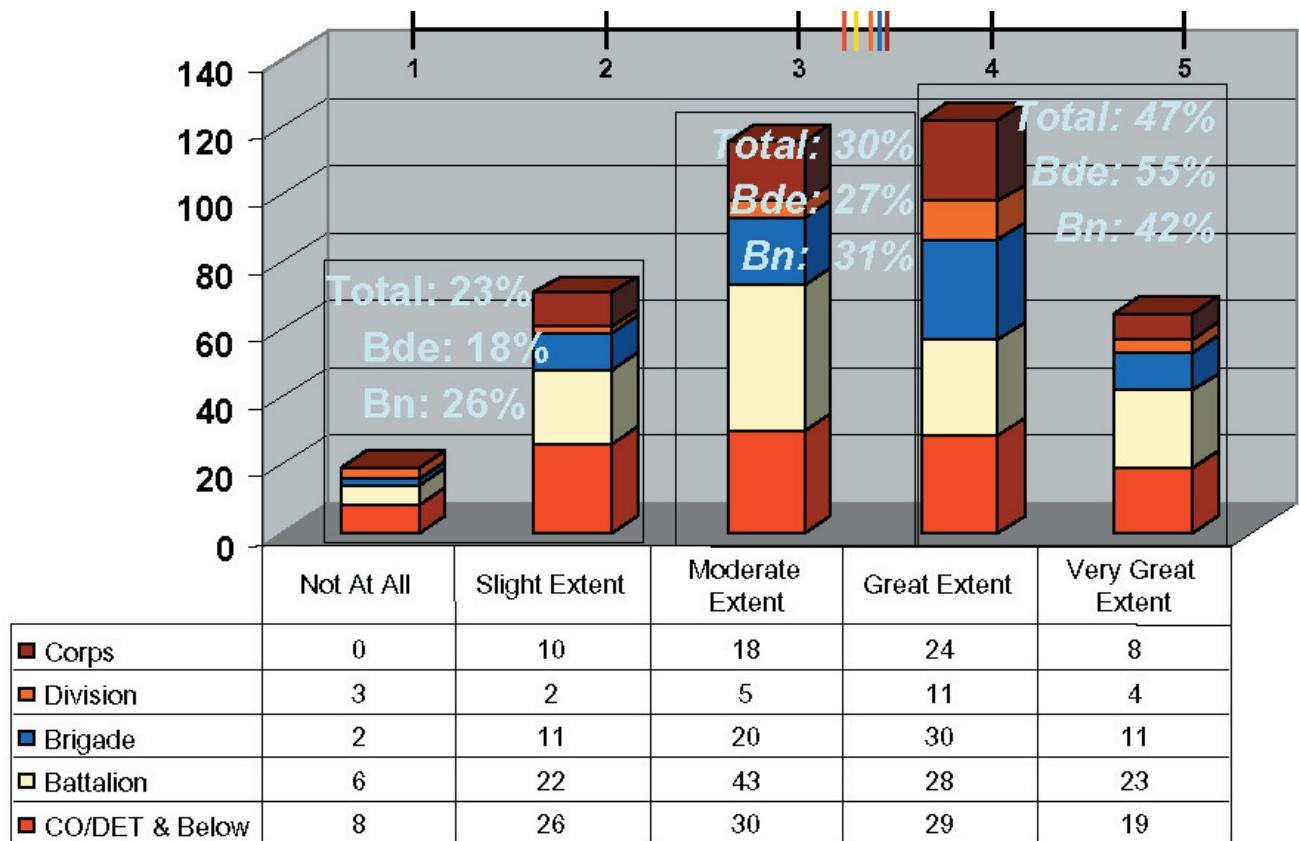
Positive Impact	Negative Impact	1	2	3	4	5
		Never Extremely –	Sometimes Neutral	Sometimes Neutral	Always Extremely +	

Level of Command	Command & Control			Maneuver		
	Prior Experience	During OIF	P value	Prior Experience	During OIF	P value
How frequently did the information you received provide an accurate “picture” of the battlespace?	3	<b>3.44</b>	0.02			
How frequently did you feel that your awareness of key battlespace operating system (BOS) elements was complete	2.97	<b>3.34</b>	0.02			
How would you rate the impact of information systems on your ability to coordinate actions and/or weapon system capabilities?				3.23	<b>3.51</b>	0.01
How frequently did the timeliness and accuracy of information allow you to coordinate actions/operations among other units/organizations/services?	3.07	<b>3.29</b>	0.05	2.93	<b>3.23</b>	0.03
How frequently did information systems provide situational awareness of key battlespace (BOS) elements in order to allow you to make timely decisions?	2.9	<b>3.19</b>	0.03	2.82	<b>3.32</b>	0
How frequently did the quantity, quality, timeliness and ability to share information allow you to take actions to mitigate/minimize risk?	3.03	<b>3.42</b>	0.01	2.89	<b>3.22</b>	0.01
How frequently did the quantity, quality, timeliness and ability to share information have a positive impact on operational tempo	2.82	3.23	0.06	2.85	<b>3.05</b>	0.03
How would you rate the overall quality of service for information systems?	2.68	<b>3.16</b>	0.02	2.61	<b>2.9</b>	0.03

Level of Command	Command & Control			Maneuver		
	Prior Experience	During OIF	P value	Prior Experience	During OIF	P value
Questions						
How would you rate the impact of information systems on your ability to share actionable/targetable information?	3.28	<b>2.9</b>	0.04	3.46	<b>3.13</b>	0.01
How would you rate the impact of information systems on your ability to coordinate actions and/or weapon system capabilities?	3.28	<b>2.87</b>	0.04	3.39	<b>3.11</b>	0.01
How frequently did the quantity, quality, timeliness, and ability to share information allow you to be fully aware of the risk you were accepting?	3.2	<b>2.63</b>	0.03			
How would you rate the overall quality of service for information systems?	2.66	<b>2.17</b>	0.05	2.67	<b>2.37</b>	0.01

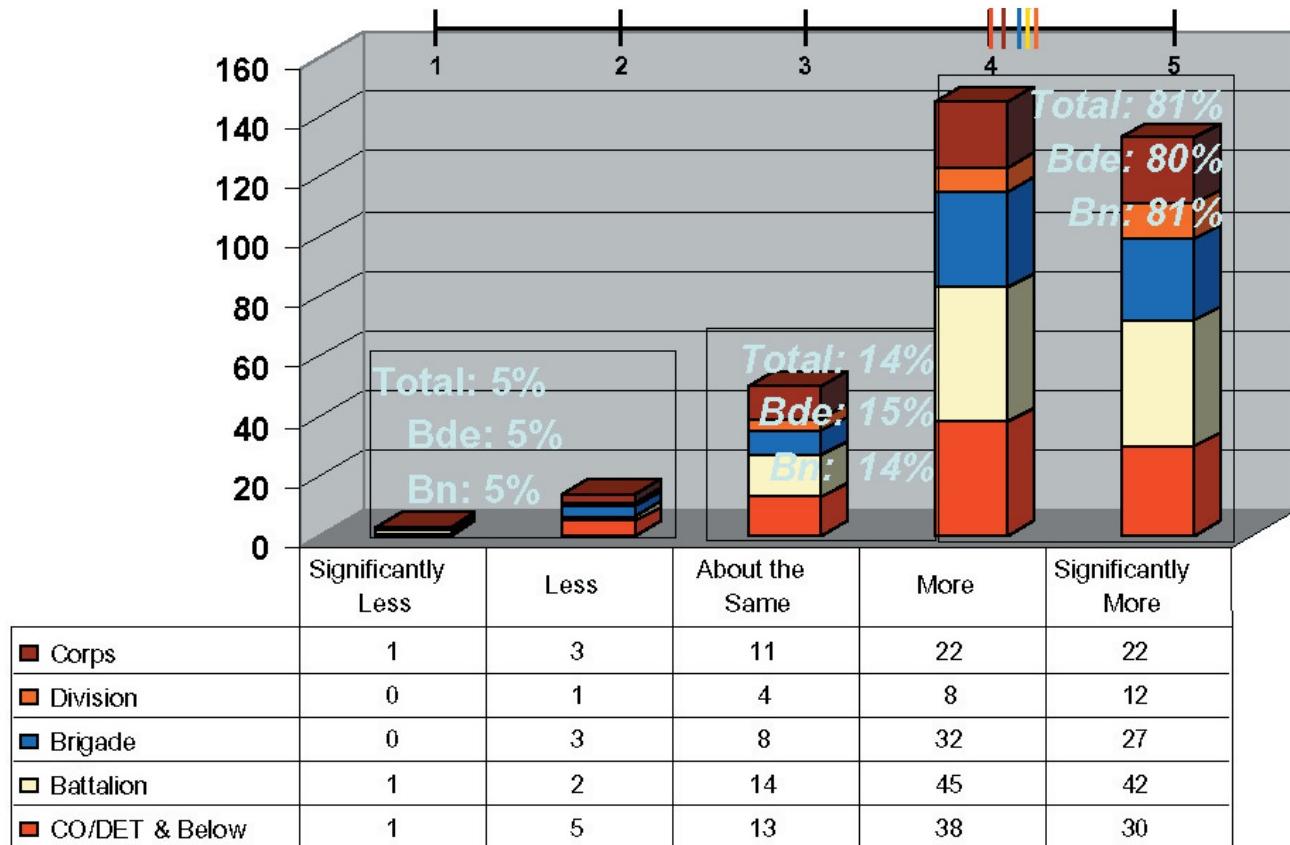
## Section 2. B – Supporting Data And Graphs By Level Of Command:

1. To what extent do you feel the new systems improved combat operations and enhanced combat effectiveness?



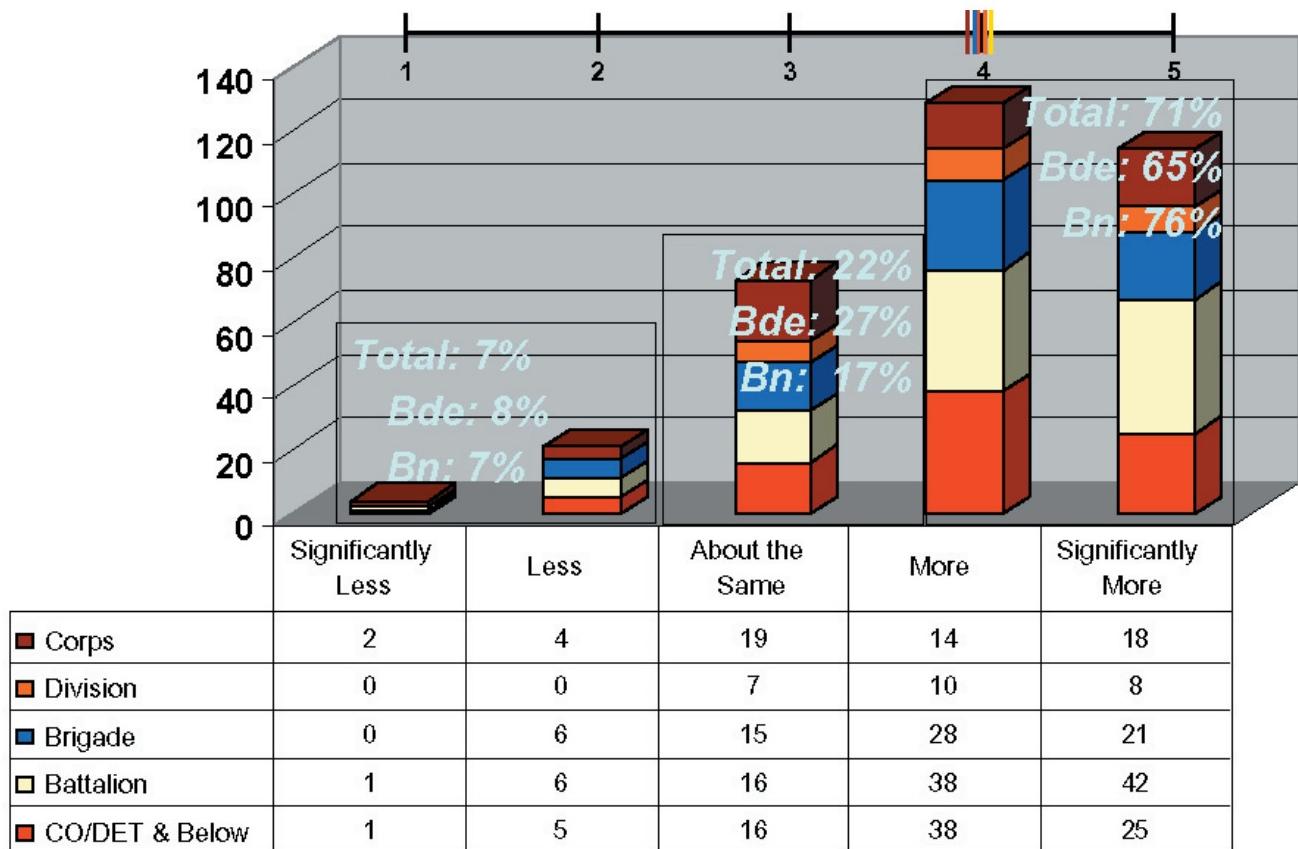
	CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses	112	122	74	25	60	234	159
Mean	3.22	3.33	3.50	3.44	3.50	3.28	3.49
95% Confidence Interval for Mean	Lower Bound	3.00	3.13	3.27	2.93	3.26	3.13
	Upper Bound	3.45	3.53	3.73	3.95	3.74	3.65
Median	3.00	3.00	4.00	4.00	4.00	3.00	4.00
Variance	1.418	1.264	1.021	1.507	.864	1.335	1.024
Std. Deviation	1.191	1.124	1.010	1.227	.930	1.155	1.012

2. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how capable were the new systems?



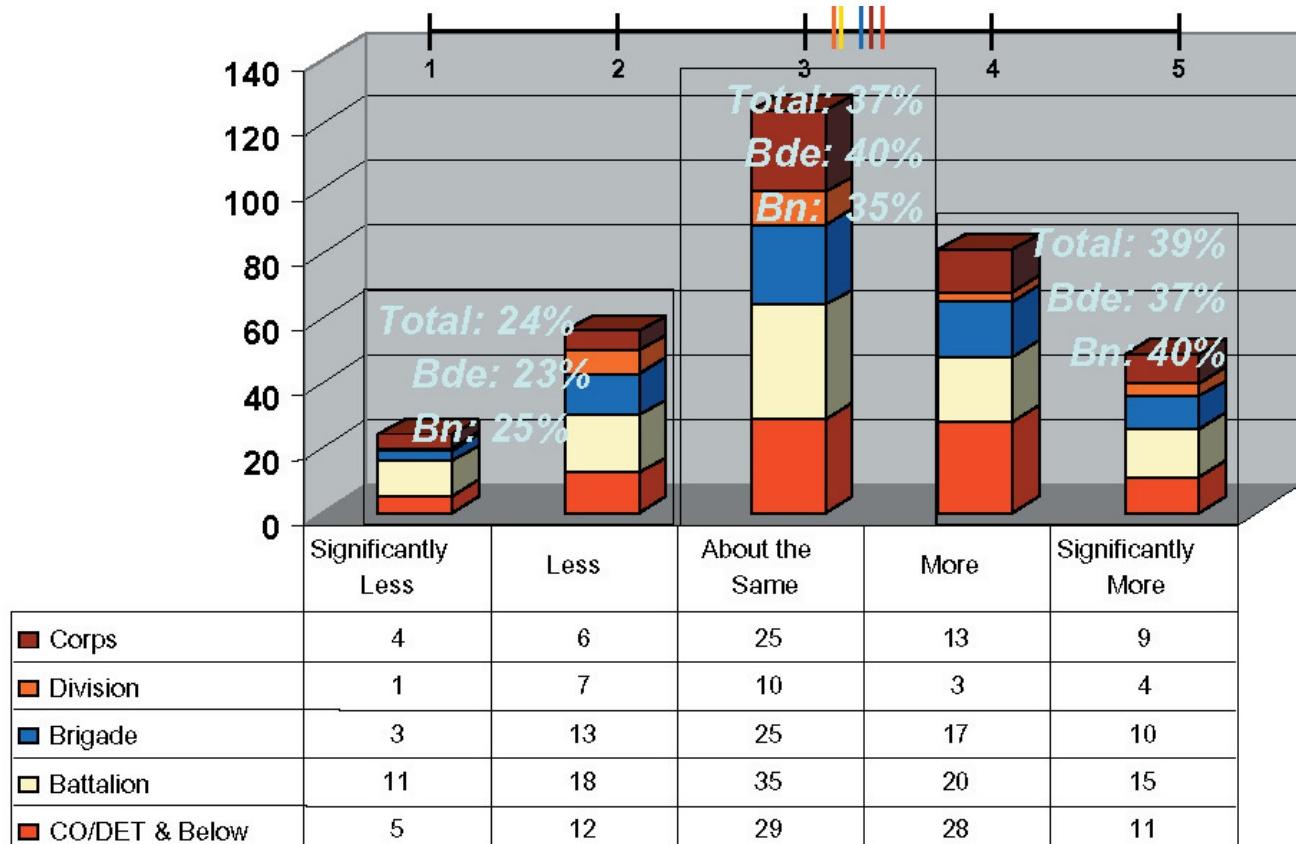
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		87	104	70	25	59	191	154
Mean		4.05	4.20	4.19	4.24	4.03	4.13	4.14
95% Confidence Interval for Mean	Lower Bound	3.85	4.04	3.99	3.88	3.78	4.01	4.00
	Upper Bound	4.24	4.36	4.38	4.60	4.29	4.25	4.28
Median		4.00	4.00	4.00	4.00	4.00	4.00	4.00
Variance		.835	.668	.646	.773	.930	.746	.772
Std. Deviation		.914	.817	.804	.879	.964	.864	.879

3. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how much connectivity did the new systems provide?



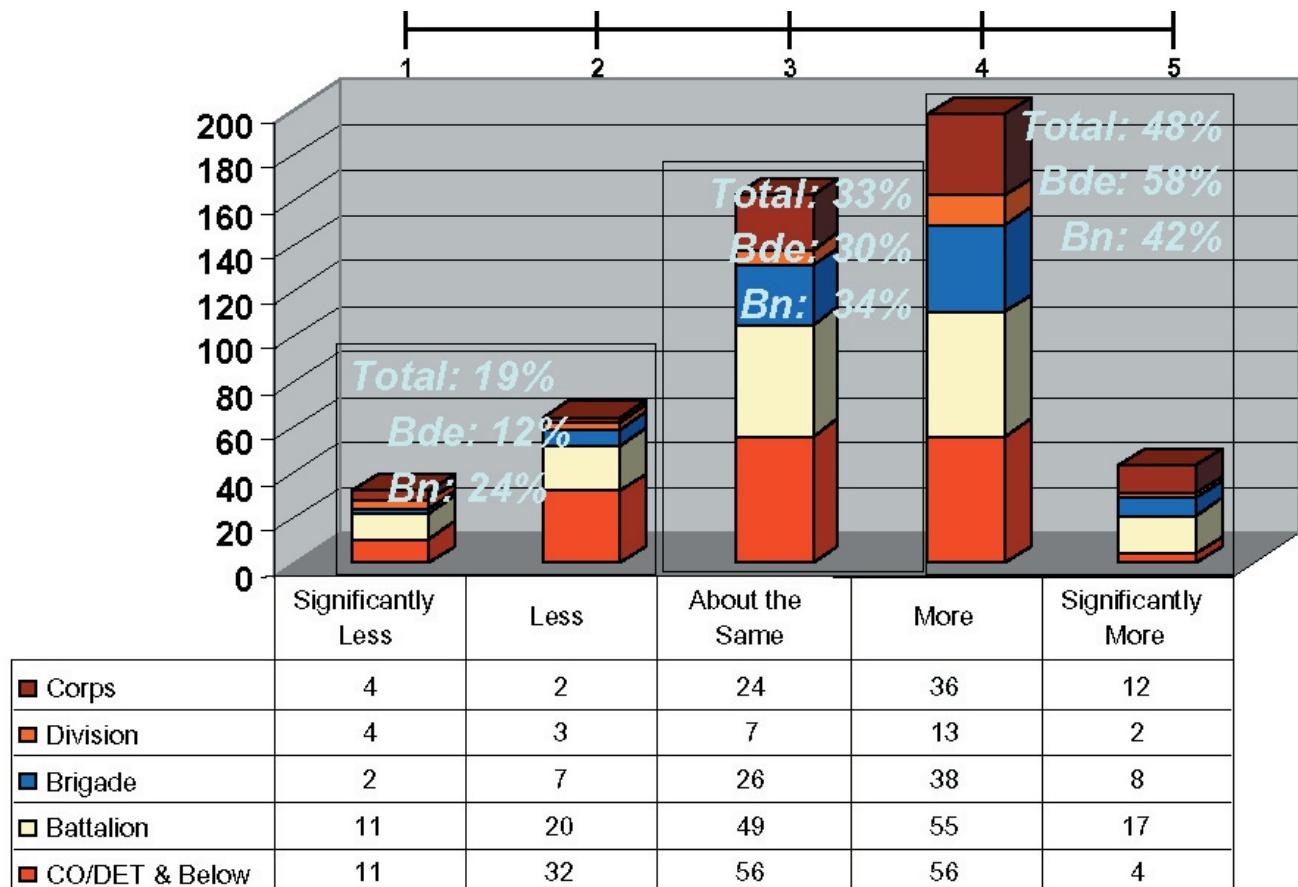
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		85	103	70	25	57	188	152
Mean		3.95	4.11	3.91	4.04	3.74	4.04	3.87
95% Confidence Interval for Mean	Lower Bound	3.76	3.92	3.69	3.71	3.45	3.90	3.71
	Up- per Bound	4.15	4.29	4.14	4.37	4.03	4.17	4.02
Median		4.00	4.00	4.00	4.00	4.00	4.00	4.00
Variance		.831	.881	.862	.623	1.197	.860	.949
Std. Deviation		.912	.938	.928	.790	1.094	.927	.974

4. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how compatible were the new systems with other systems?



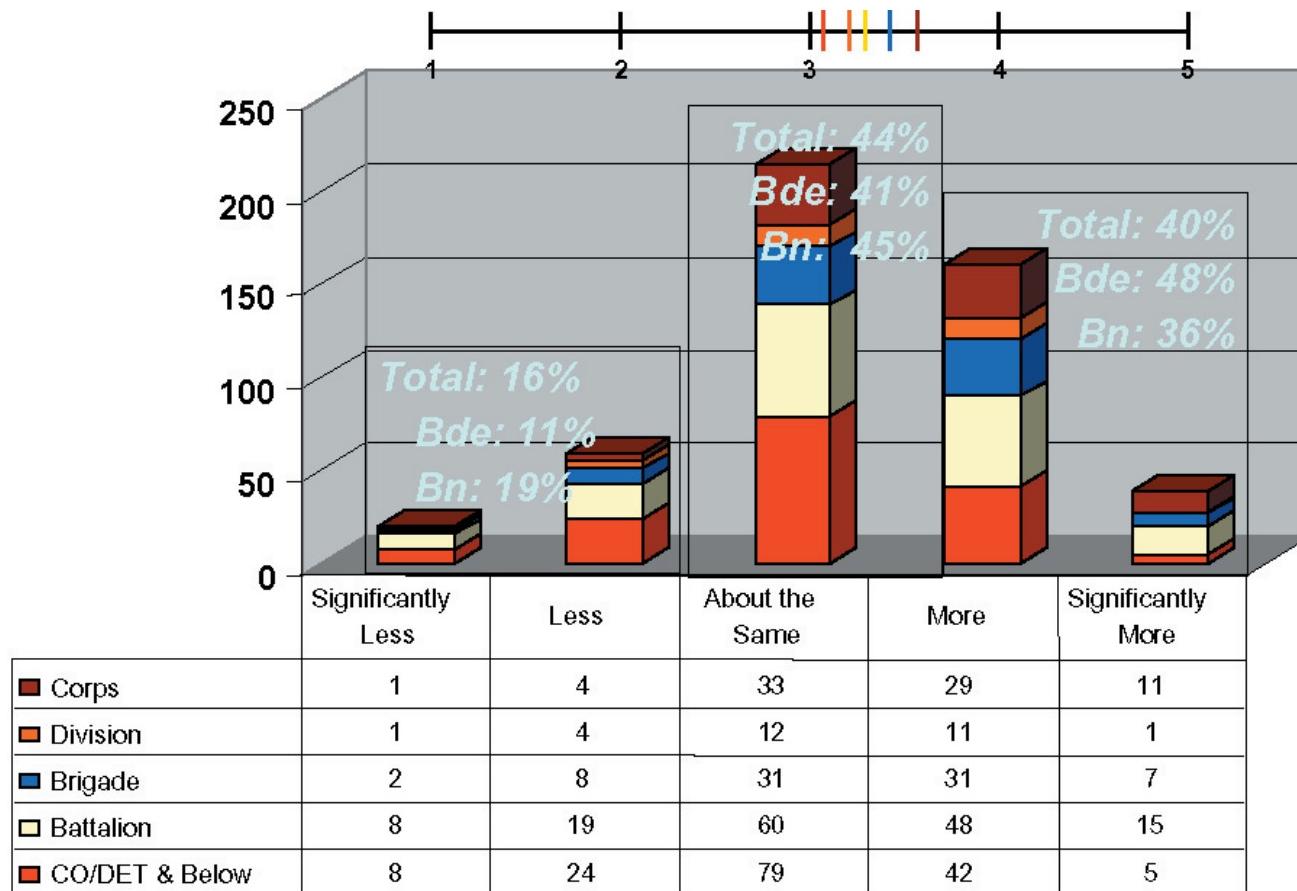
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		88	99	68	25	57	187	150
Mean		3.33	3.10	3.26	3.08	3.30	3.21	3.25
95% Confidence Interval for Mean	Lower Bound	3.10	2.86	3.00	2.62	3.01	3.04	3.07
	Upper Bound	3.56	3.34	3.52	3.54	3.59	3.37	3.42
Median		3.00	3.00	3.00	3.00	3.00	3.00	3.00
Variance		1.128	1.439	1.153	1.243	1.177	1.301	1.167
Std. Deviation		1.062	1.199	1.074	1.115	1.085	1.141	1.080

5. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how timely was the information you received?



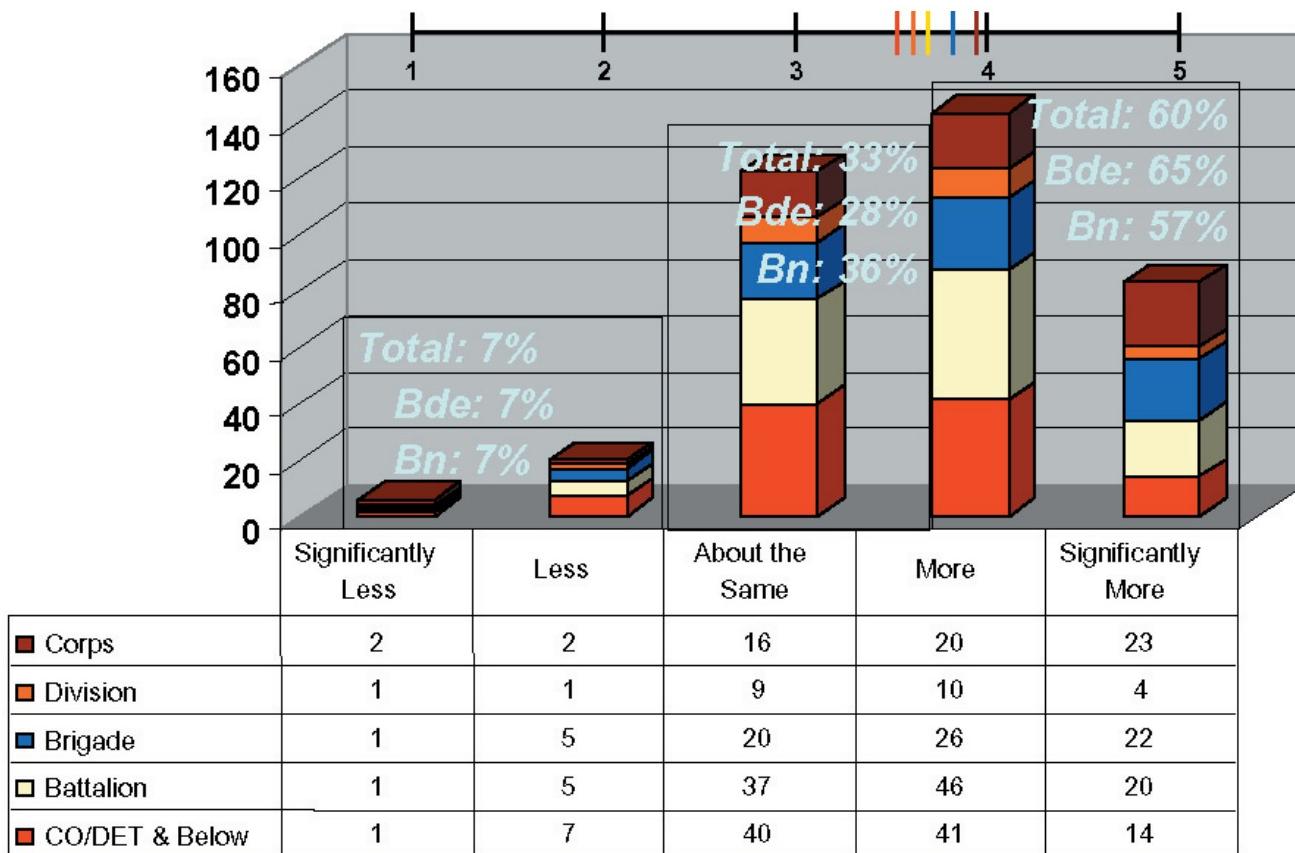
	CO/DET	Battalion	Brigade	Division	CORPs	Battalion & Below	Brigade& Above
Responses	159	152	81	29	78	311	188
Mean	3.06	3.31	3.53	3.21	3.64	3.18	3.53
95% Confidence Interval for Mean	Lower Bound	2.91	3.14	3.34	2.76	3.43	3.07
	Upper Bound	3.21	3.48	3.73	3.65	3.86	3.30
Median	3.00	3.00	4.00	4.00	4.00	3.00	4.00
Variance	.933	1.142	.777	1.384	.908	1.047	.935
Std. Deviation	.966	1.069	.882	1.177	.953	1.023	.967

6. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how accurate was the information you received?



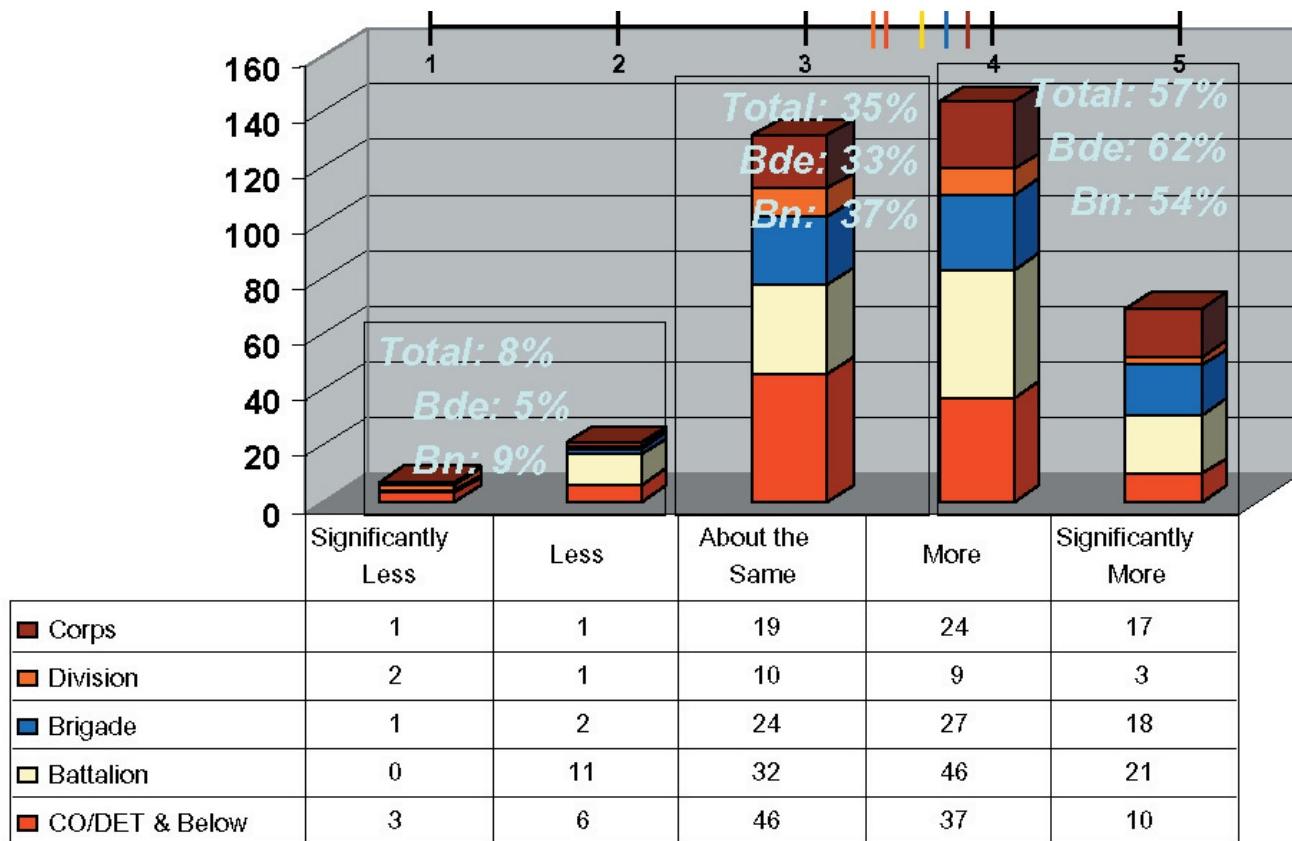
	CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses	158	150	79	29	78	308	186
Mean	3.08	3.29	3.42	3.24	3.58	3.18	3.46
95% Confidence Interval for Mean	Lower Bound	2.94	3.13	3.22	2.91	3.39	3.07
	Upper Bound	3.21	3.45	3.62	3.57	3.77	3.28
Median	3.00	3.00	3.00	3.00	4.00	3.00	3.00
Variance	.746	.984	.785	.761	.715	.870	.758
Std. Deviation	.864	.992	.886	.872	.845	.933	.870

7. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMT), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how timely was the information received from the new systems?



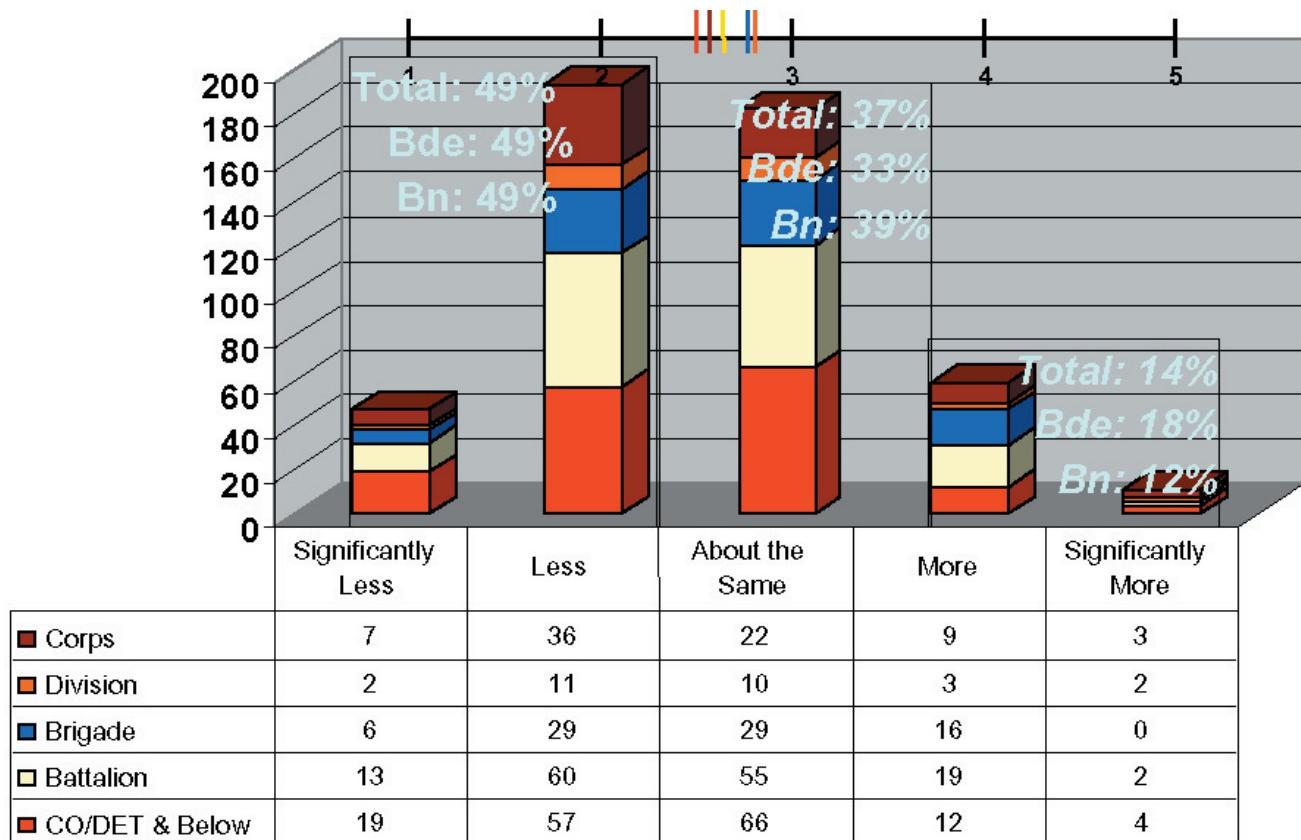
	CO/DET	Battalion	Brigade	Division	CORP-S SCorps	Battalion & Below	Brigade & Above
Responses	103	109	74	25	63	212	162
Mean	3.58	3.72	3.85	3.60	3.95	3.66	3.85
95% Confidence Interval for Mean	Lower Bound	3.42	3.56	3.63	3.20	3.69	3.54
	Upper Bound	3.75	3.89	4.08	4.00	4.21	4.01
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Variance	.716	.720	.950	.917	1.046	.720	.984
Std. Deviation	.846	.848	.975	.957	1.023	.848	.992

8. In comparison to information/communication systems you used in the past (during deployments, CTC rotations (NTC/JRTC/CMTC), and other major training events), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how accurate was the information received from the new systems?



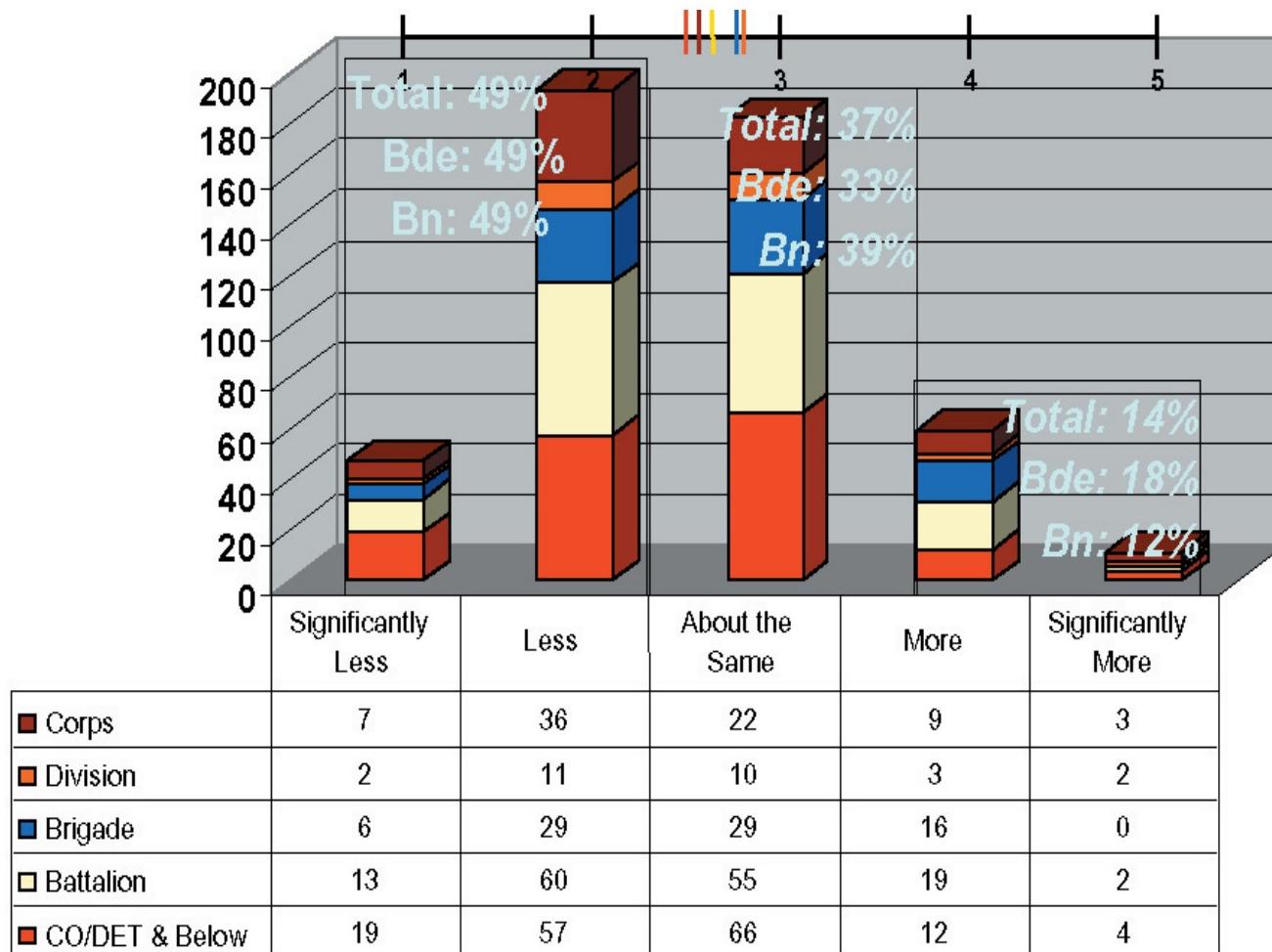
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		103	109	74	25	63	212	162
Mean		3.44	3.70	3.82	3.40	3.89	3.58	3.78
95% Confidence Interval for Mean	Lower Bound	3.27	3.53	3.61	2.97	3.66	3.46	3.63
	Upper Bound	3.61	3.87	4.03	3.83	4.11	3.70	3.92
Median		3.00	4.00	4.00	3.00	4.00	4.00	4.00
Variance		.744	.799	.798	1.083	.790	.786	.856
Std. Deviation		.863	.894	.893	1.041	.889	.886	.925

9. In comparison to previous experiences (deployments, CTC rotations, etc.), based on the timeliness and accuracy of information you received during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how much time did it take to make decisions?



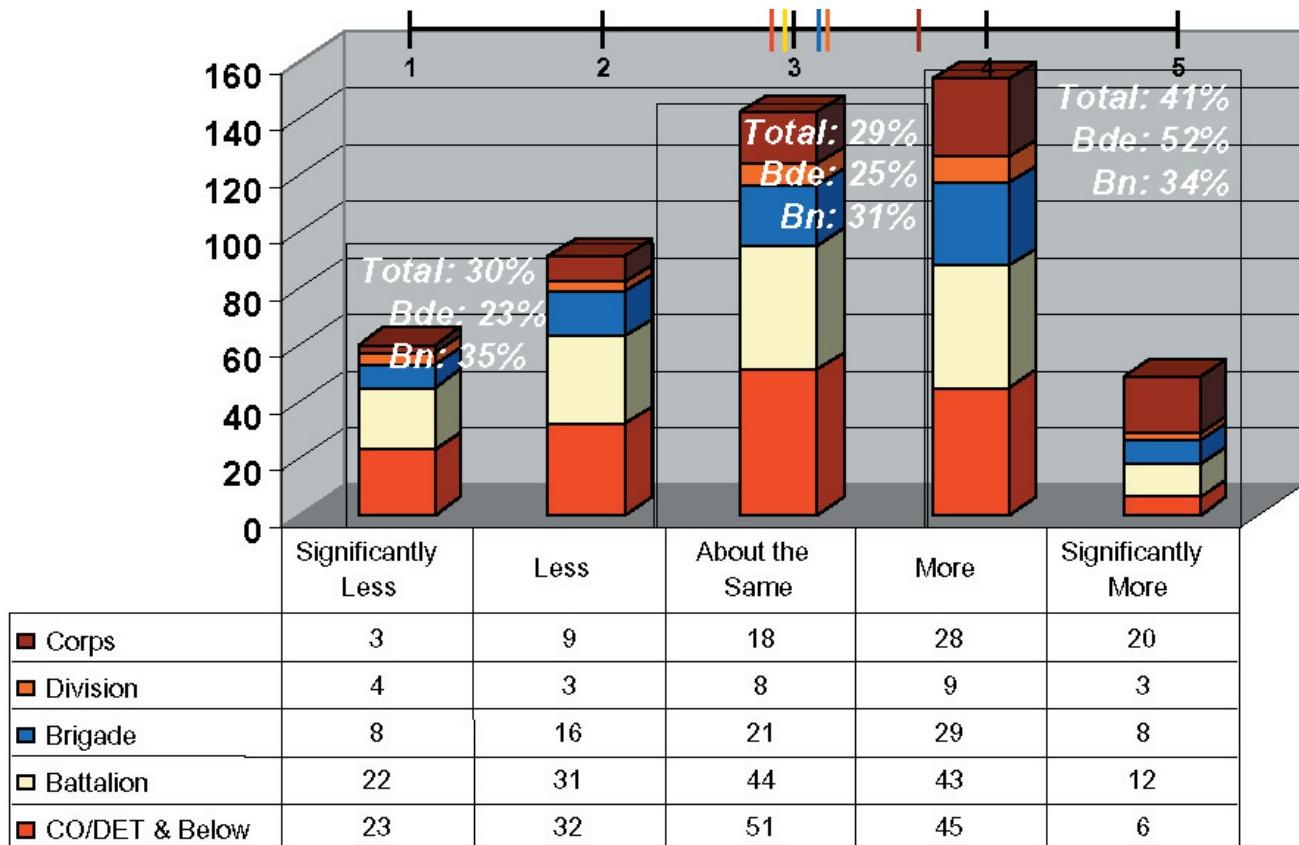
	CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses	158	149	80	28	77	307	185
Mean	2.53	2.58	2.69	2.71	2.55	2.55	2.63
95% Confidence Interval for Mean	Lower Bound	2.38	2.44	2.49	2.32	2.33	2.45
	Upper Bound	2.67	2.72	2.88	3.11	2.76	2.77
Median	3.00	3.00	3.00	3.00	2.00	3.00	3.00
Variance	.799	.759	.775	1.026	.909	.778	.864
Std. Deviation	.894	.871	.880	1.013	.953	.882	.930

10. In comparison to previous experiences (deployments, CTC rotations, etc.), based on the timeliness and accuracy of information you received during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how much confidence did you have in the decisions that were made?



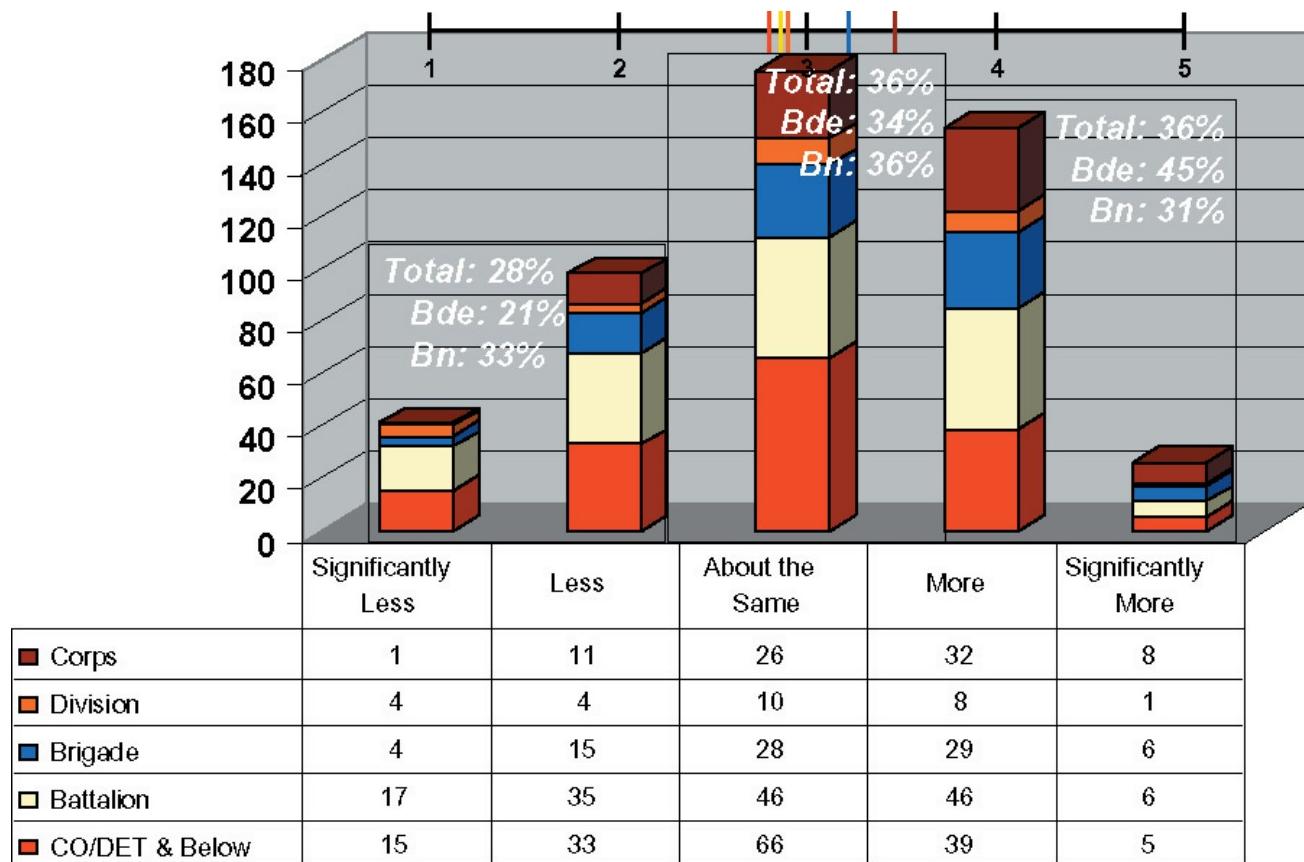
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		157	150	81	28	77	307	186
Mean		3.40	3.46	3.52	3.14	3.56	3.43	3.48
95% Confidence Interval for Mean	Lower Bound	3.26	3.32	3.35	2.78	3.37	3.33	3.36
	Upper Bound	3.54	3.60	3.68	3.50	3.74	3.53	3.60
Median		3.00	4.00	4.00	3.00	3.00	3.00	3.00
Variance		.780	.747	.553	.868	.671	.762	.662
Std. Deviation		.883	.864	.743	.932	.819	.873	.813

11. Compared to previous experiences (deployments, CTC rotations, etc.), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how much connectivity did you have with others?



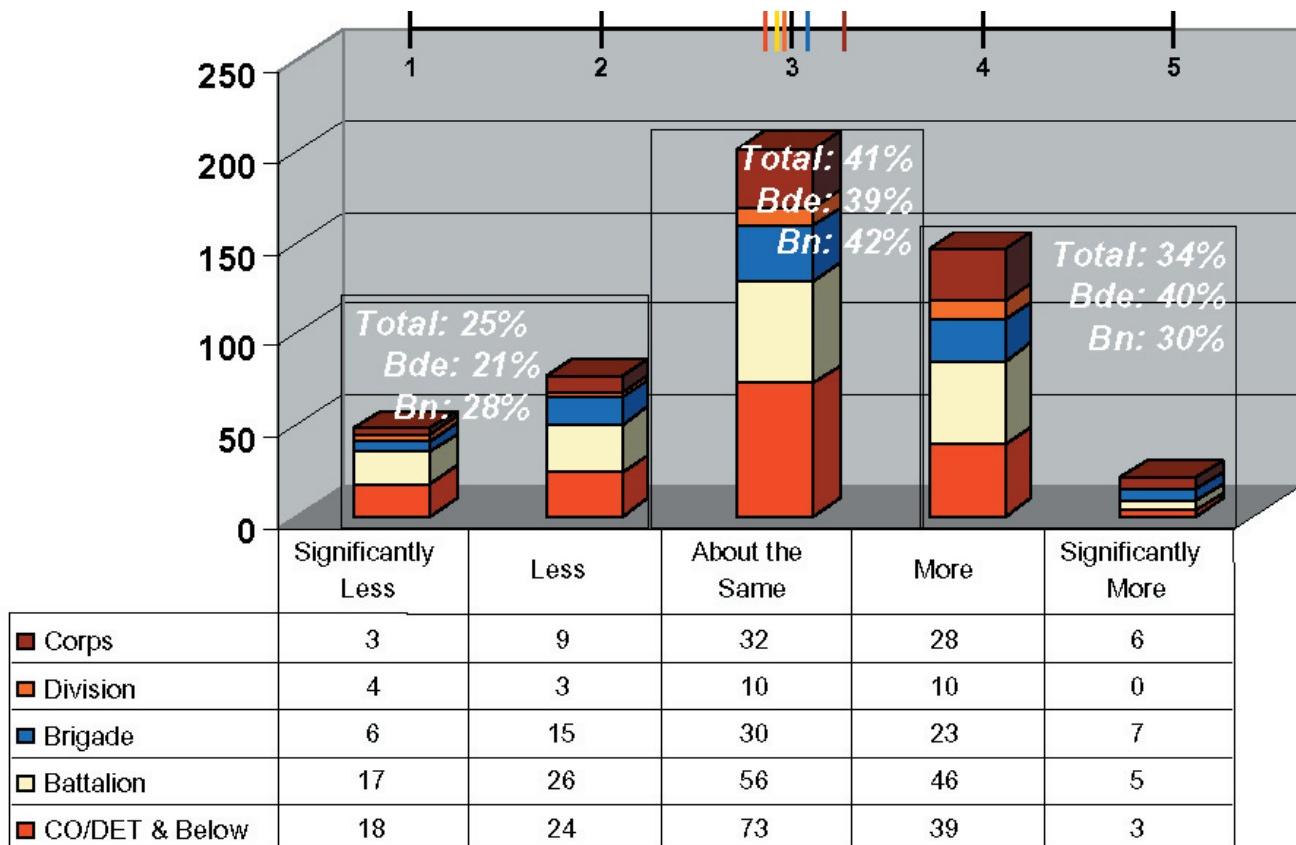
	CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses	157	152	82	27	78	309	187
Mean	2.87	2.95	3.16	3.15	3.68	2.91	3.37
95% Confidence Interval for Mean	Lower Bound	2.69	2.76	2.91	2.66	3.43	2.78
	Upper Bound	3.04	3.14	3.41	3.64	3.93	3.54
Median	3.00	3.00	3.00	3.00	4.00	3.00	4.00
Variance	1.219	1.388	1.320	1.516	1.208	1.300	1.354
Std. Deviation	1.104	1.178	1.149	1.231	1.099	1.140	1.164

12. In comparison to previous experiences (deployments, CTC rotations, etc.), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how would you rate the service quality of information systems?



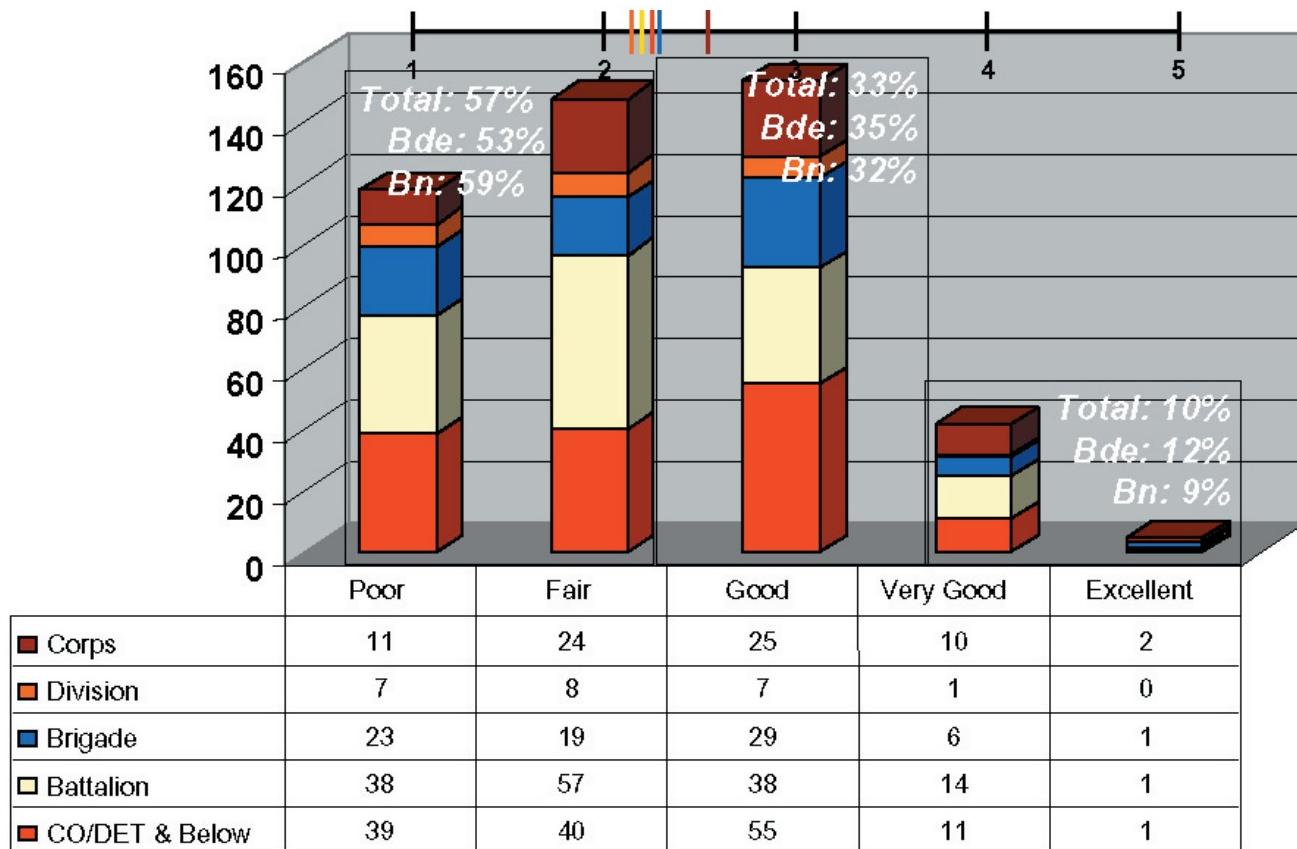
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		158	150	82	27	78	308	187
Mean		2.91	2.93	3.22	2.93	3.45	2.92	3.27
95% Confidence Interval for Mean	Lower Bound	2.76	2.75	3.00	2.49	3.24	2.80	3.13
	Upper Bound	3.07	3.10	3.44	3.36	3.65	3.03	3.42
Median		3.00	3.00	3.00	3.00	4.00	3.00	3.00
Variance		.960	1.156	.988	1.225	.822	1.052	.974
Std. Deviation		.980	1.075	.994	1.107	.907	1.026	.987

13. In comparison to previous experiences (deployments, CTC rotations, etc.), during the major combat operations phase of OIF (20 MAR 03 – 1 MAY 03), how reliable were the information systems?



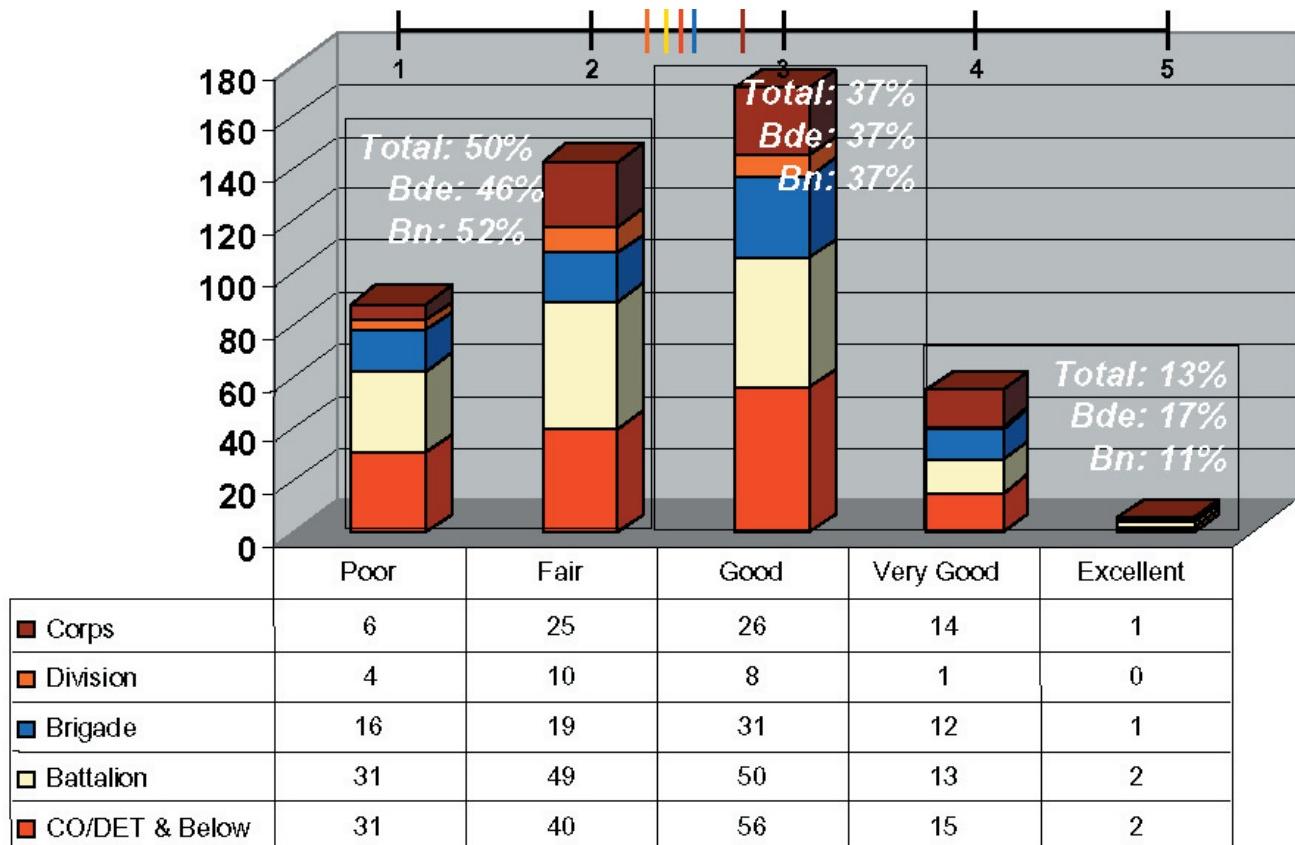
	CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses	157	150	81	27	78	307	186
Mean	2.90	2.97	3.12	2.96	3.32	2.94	3.18
95% Confidence Interval for Mean	Lower Bound	2.75	2.81	2.89	2.55	3.11	2.83
	Upper Bound	3.06	3.14	3.36	3.38	3.53	3.33
Median	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Variance	.933	1.073	1.110	1.114	.844	.999	1.004
Std. Deviation	.966	1.036	1.053	1.055	.919	1.000	1.002

14. During the major combat operations phase of OIF, how would you rate the compatibility of information systems to share information with other systems?



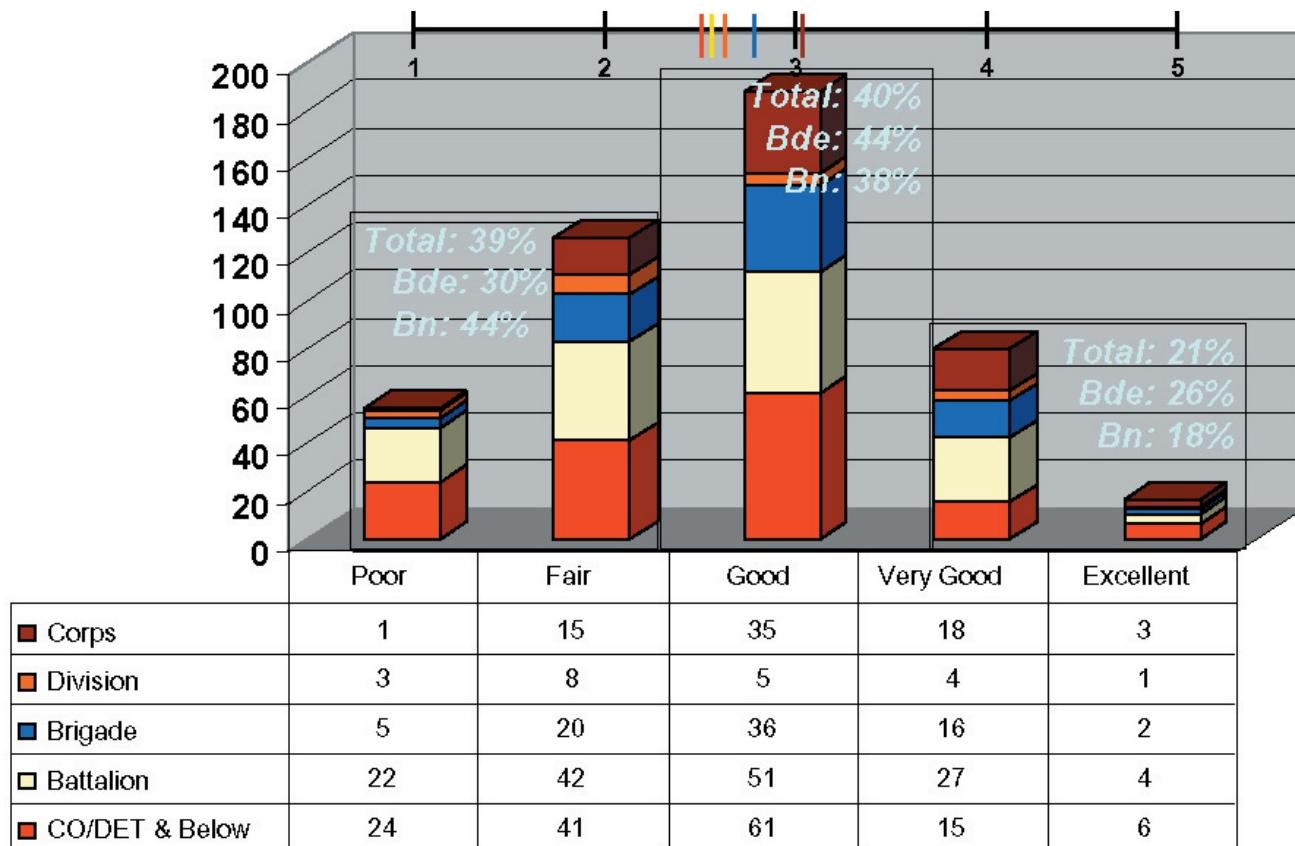
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		146	148	78	23	72	294	173
Mean		2.28	2.21	2.27	2.09	2.56	2.24	2.36
95% Confidence Interval for Mean	Lower Bound	2.12	2.05	2.04	1.70	2.32	2.13	2.21
	Upper Bound	2.44	2.36	2.50	2.48	2.79	2.36	2.52
Median		2.00	2.00	2.00	2.00	3.00	2.00	2.00
Variance		.934	.915	1.030	.810	1.011	.923	1.012
Std. Deviation		.967	.957	1.015	.900	1.005	.961	1.006

15. During the major combat operations phase of OIF, how would you rate the performance of information systems in allowing interaction with others?



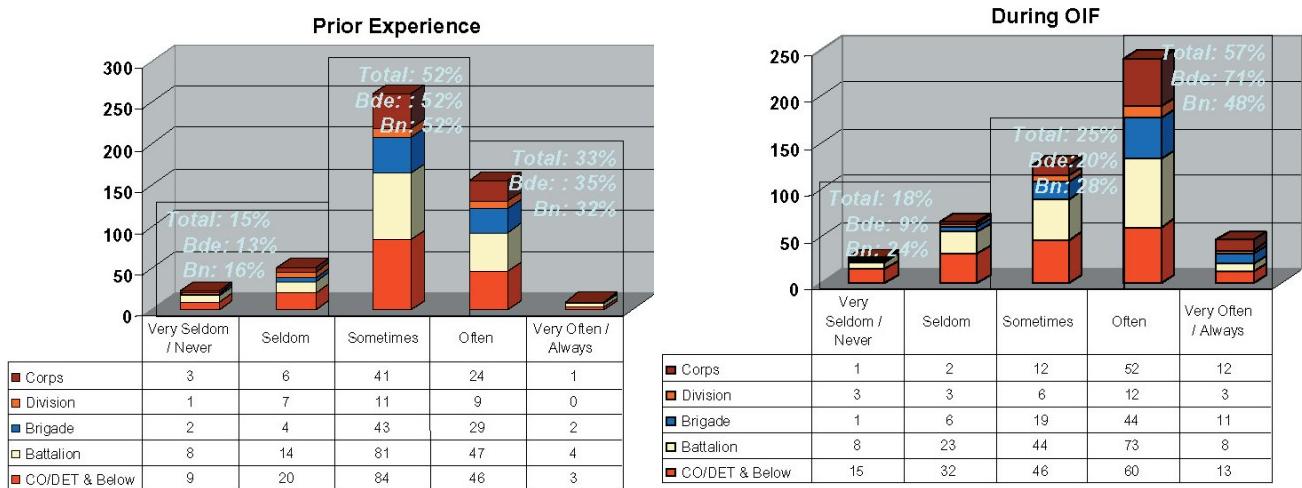
		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		144	145	79	23	72	289	174
Mean		2.42	2.35	2.53	2.26	2.71	2.39	2.57
95% Confidence Interval for Mean	Lower Bound	2.26	2.19	2.30	1.91	2.49	2.27	2.42
	Upper Bound	2.59	2.51	2.76	2.61	2.93	2.50	2.71
Median		3.00	2.00	3.00	2.00	3.00	2.00	3.00
Variance		.973	.924	1.047	.656	.857	.947	.929
Std. Deviation		.986	.961	1.023	.810	.926	.973	.964

16. During the major combat operations phase of OIF, how would you rate the timeliness of information received in providing battlespace awareness?



		CO/DET	Battalion	Brigade	Division	CORP-SCorps	Battalion & Below	Brigade & Above
Responses		147	146	78	21	72	293	171
Mean		2.58	2.65	2.87	2.62	3.10	2.61	2.94
95% Confidence Interval for Mean	Lower Bound	2.41	2.48	2.67	2.11	2.90	2.50	2.80
	Upper Bound	2.74	2.82	3.07	3.13	3.29	2.73	3.07
Median		3.00	3.00	3.00	2.00	3.00	3.00	3.00
Variance		1.026	1.070	.804	1.248	.681	1.046	.820
Std. Deviation		1.013	1.035	.897	1.117	.825	1.023	.906

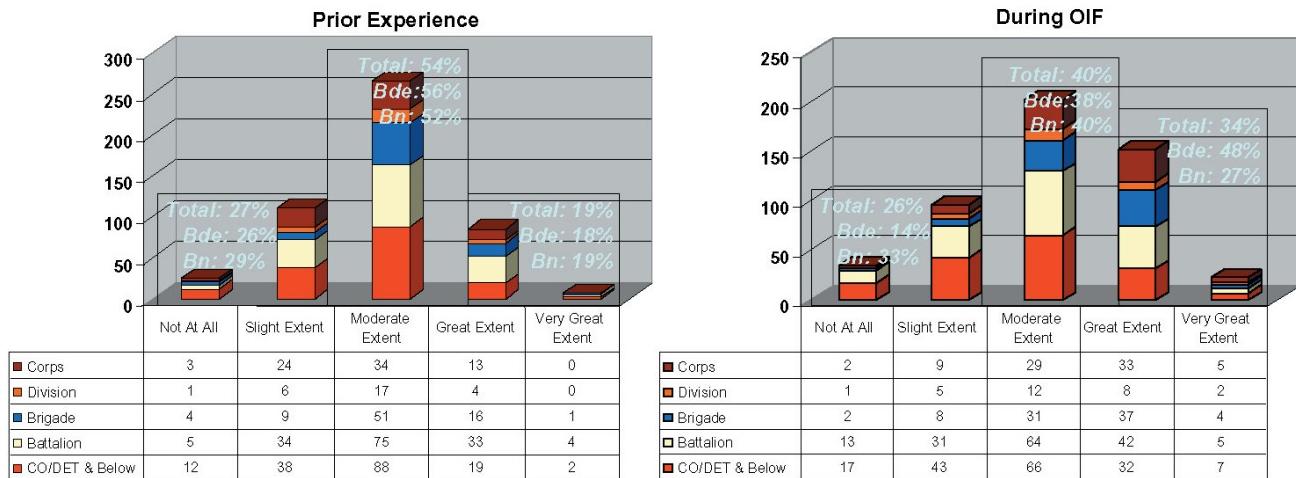
17. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the information you received provide an accurate “picture” of the battlespace?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		162	166	154	156	80	81	28	27	75	79
Mean		3.09	3.14	3.16	3.32	3.31	3.72	3.00	3.33	3.19	3.91
95% CI for Mean	Lower Bound	2.98	3.03	3.17	3.15	3.53	2.67	2.87	3.01	3.75	3.19
	Upper Bound	3.31	3.29	3.47	3.47	3.90	3.33	3.80	3.36	4.07	3.58
Median		3.00	3.00	3.00	4.00	3.00	4.00	3.00	4.00	3.00	4.00
Variance		.701	1.215	.686	.929	.521	.706	.741	1.385	.586	.518
Std. Deviation		.837	1.102	.828	.964	.722	.840	.861	1.177	.766	.720

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	Prior
Responses		316	322	183	187
Mean		3.12	3.23	3.21	3.74
95% CI for Mean	Lower Bound	3.12	3.10	3.62	3.24
	Upper Bound	3.34	3.32	3.87	3.49
Median		3.00	3.00	3.00	4.00
Variance		.693	1.081	.586	.751
Std. Deviation		.832	1.040	.766	.867

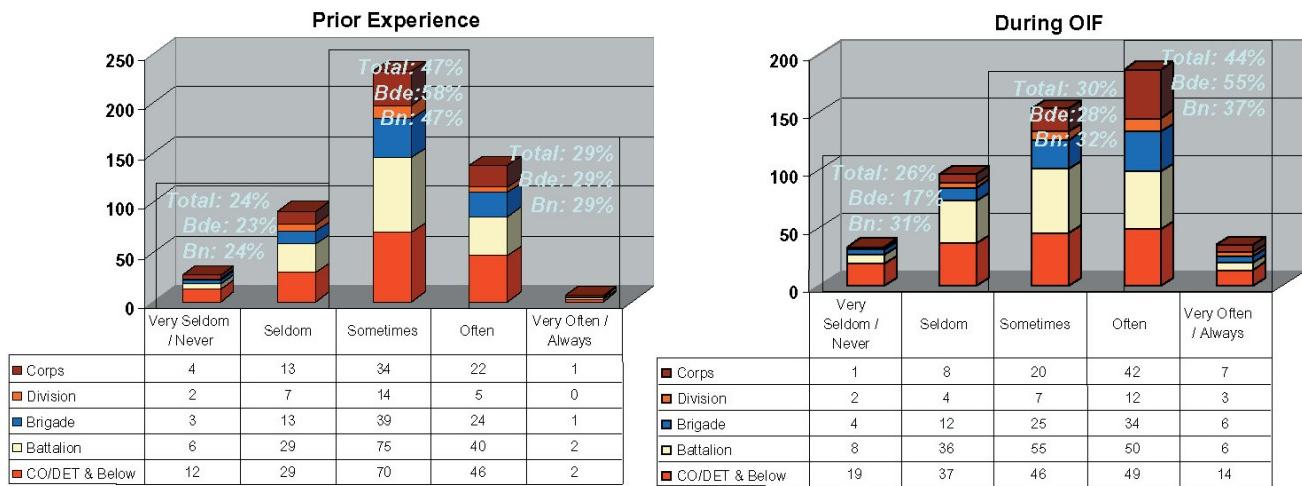
18. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), to what extent did the quantity, quality, and timeliness of information provided allow you to modify your planning processes or plans prior to execution?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		159	165	151	155	81	82	28	28	74	78
Mean		2.75	2.81	2.98	2.97	3.01	3.40	2.86	3.18	2.77	3.38
95% CI for Mean	Lower Bound	2.63	2.66	2.85	2.81	2.85	3.22	2.58	2.81	2.59	3.19
	Upper Bound	2.88	2.97	3.11	3.12	3.18	3.58	3.13	3.54	2.95	3.58
Median		3.00	3.00	3.00	3.00	3.00	3.50	3.00	3.00	3.00	3.00
Variance		.655	1.007	.686	.941	.562	.688	.497	.893	.618	.759
Std. Deviation		.809	1.004	.828	.970	.750	.829	.705	.945	.786	.871

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		310	320	183	188
Mean		2.86	2.89	2.89	3.36
95% CI for Mean	Lower Bound	2.77	2.78	2.78	3.24
	Upper Bound	2.96	3.00	3.00	3.49
Median		3.00	3.00	3.00	3.00
Variance		.681	.978	.581	.745
Std. Deviation		.825	.989	.762	.863

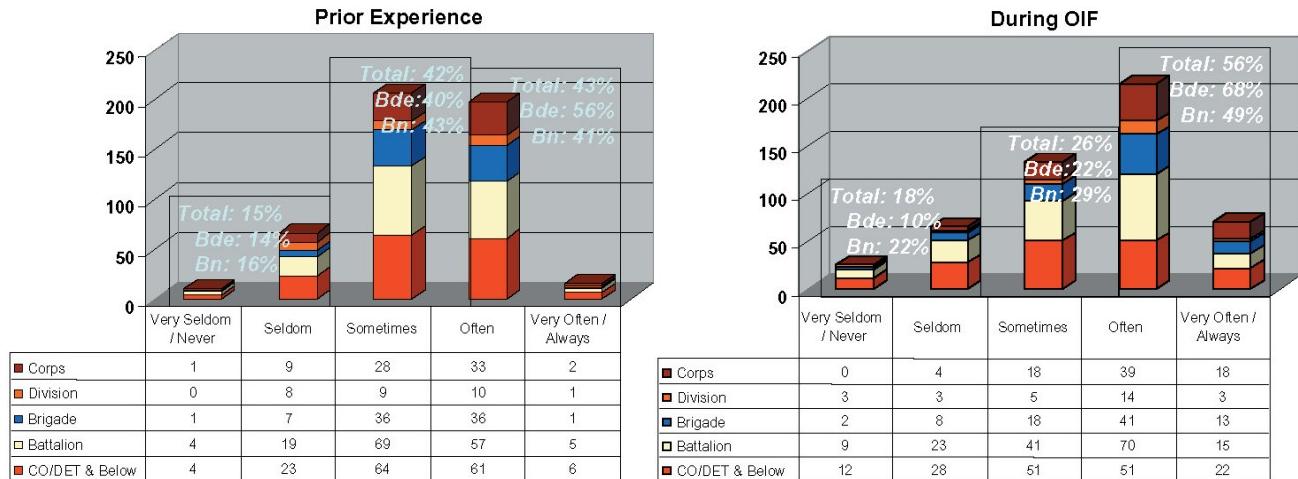
19. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did you feel that your awareness of key battlespace operating system (BOS) elements was complete (meaning you were aware of everything you needed to be aware of)?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		159	165	152	155	80	81	28	28	74	78
Mean		2.98	3.01	3.02	3.06	3.09	3.32	2.79	3.36	3.04	3.59
95% CI for Mean	Lower Bound	2.84	2.83	2.89	2.91	2.91	3.10	2.46	2.93	2.84	3.40
	Upper Bound	3.12	3.19	3.15	3.22	3.27	3.54	3.11	3.78	3.24	3.78
Median		3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00
Variance		.829	1.329	.668	.918	.663	.971	.693	1.201	.752	.713
Std. Deviation		.910	1.153	.818	.958	.814	.985	.833	1.096	.867	.844

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		311	320	182	187
Mean		3.00	3.04	3.02	3.44
95% CI for Mean	Lower Bound	2.90	2.92	2.90	3.30
	Upper Bound	3.10	3.15	3.14	3.58
Median		3.00	3.00	3.00	4.00
Variance		.748	1.127	.707	.903
Std. Deviation		.865	1.062	.841	.951

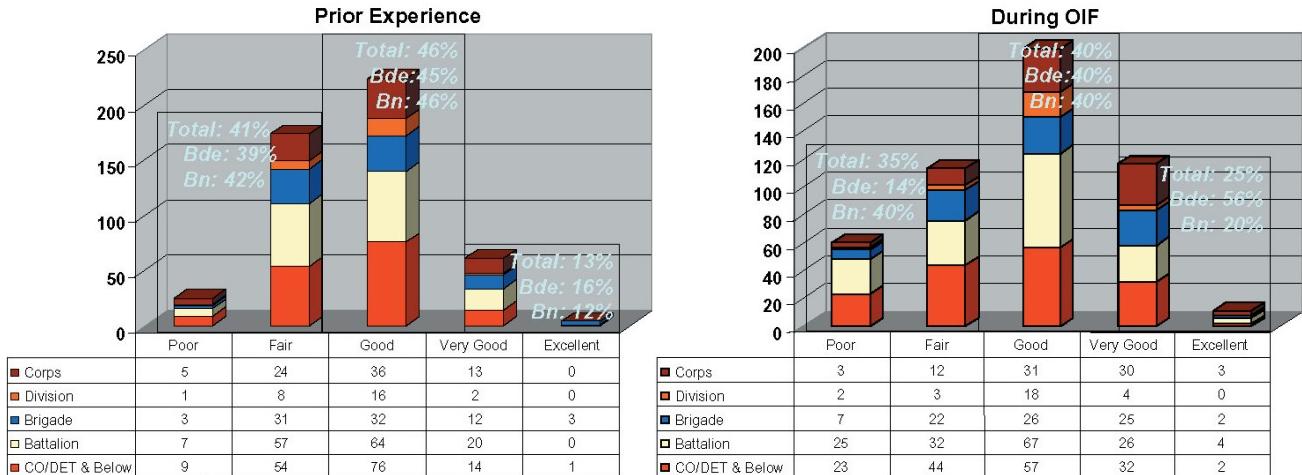
20. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did you feel you had an adequate understanding of the situation (meaning you felt you had sufficient information and awareness to understand the meaning of events)?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		158	164	154	158	81	82	28	28	73	79
Mean		3.27	3.26	3.26	3.37	3.36	3.67	3.14	3.39	3.36	3.90
95% CI for Mean	Lower Bound	3.13	3.09	3.13	3.21	3.20	3.46	2.80	2.94	3.17	3.72
	Upper Bound	3.40	3.43	3.39	3.54	3.52	3.88	3.49	3.84	3.54	4.08
Median		3.00	3.00	3.00	4.00	3.00	4.00	3.00	4.00	3.00	4.00
Variance		.719	1.250	.664	1.063	.508	.890	.794	1.358	.621	.656
Std. Deviation		.848	1.118	.815	1.031	.713	.944	.891	1.166	.788	.810

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		312	322	182	189
Mean		3.26	3.32	3.32	3.72
95% CI for Mean	Lower Bound	3.17	3.20	3.21	3.59
	Upper Bound	3.36	3.43	3.44	3.86
Median		3.00	3.00	3.00	4.00
Variance		.690	1.158	.596	.881
Std. Deviation		.830	1.076	.772	.939

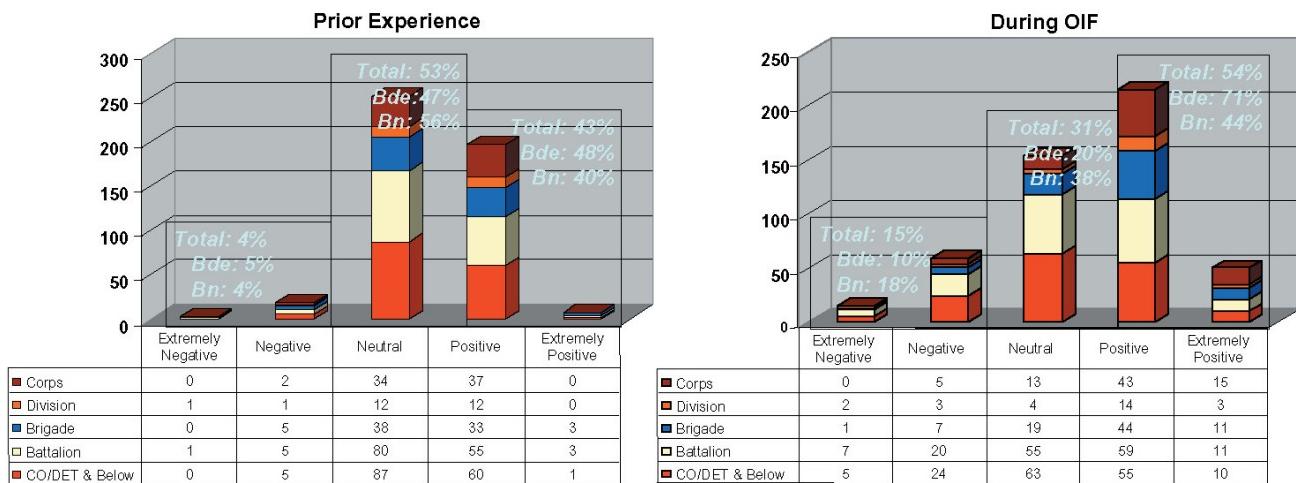
21. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the overall quality of service for information systems?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		154	158	148	154	81	82	27	27	78	79
Mean		2.64	2.66	2.66	2.69	2.77	2.91	2.70	2.89	2.73	3.23
95% CI for Mean	Lower Bound	2.52	2.50	2.53	2.53	2.57	2.69	2.44	2.59	2.55	3.03
	Upper Bound	2.76	2.82	2.78	2.85	2.96	3.14	2.97	3.19	2.91	3.43
Median		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Variance		.573	1.003	.595	1.039	.782	1.017	.447	.564	.667	.794
Std. Deviation		.757	1.002	.771	1.020	.884	1.009	.669	.751	.817	.891

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		302	312	186	188
Mean		2.65	2.67	2.74	3.04
95% CI for Mean	Lower Bound	2.56	2.56	2.62	2.91
	Upper Bound	2.73	2.79	2.86	3.18
Median		3.00	3.00	3.00	3.00
Variance		.582	1.018	.679	.875
Std. Deviation		.763	1.009	.824	.936

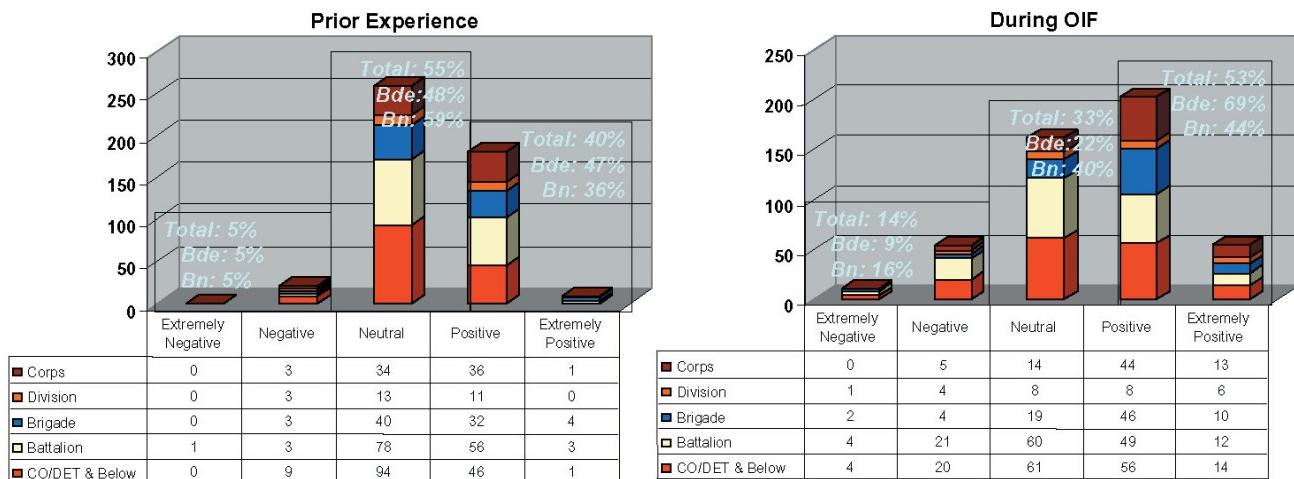
22. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the impact of information systems on your ability to share actionable/targetable information? Battalion and below finding, Brigade and above finding



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		153	157	144	152	79	82	26	26	73	76
Mean		3.37	3.26	3.38	3.31	3.43	3.70	3.35	3.50	3.48	3.89
95% CI for Mean	Lower Bound	3.28	3.12	3.27	3.16	3.28	3.51	3.05	3.05	3.35	3.71
	Upper Bound	3.46	3.40	3.48	3.46	3.58	3.88	3.65	3.95	3.61	4.08
Median		3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00
Variance		.314	.822	.390	.904	.453	.733	.555	1.220	.309	.629
Std. Deviation		.561	.907	.624	.951	.673	.856	.745	1.105	.556	.793

	Battalion & Below		Brigade & Above		
	Prior	OIF	Prior	OIF	
Responses	297	309	178	184	
Mean	3.37	3.28	3.44	3.75	
95% CI for Mean	Lower Bound	3.31	3.18	3.34	3.62
	Upper Bound	3.44	3.39	3.53	3.88
Median	3.00	3.00	3.00	4.00	
Variance	.350	.860	.406	.768	
Std. Deviation	.591	.927	.637	.876	

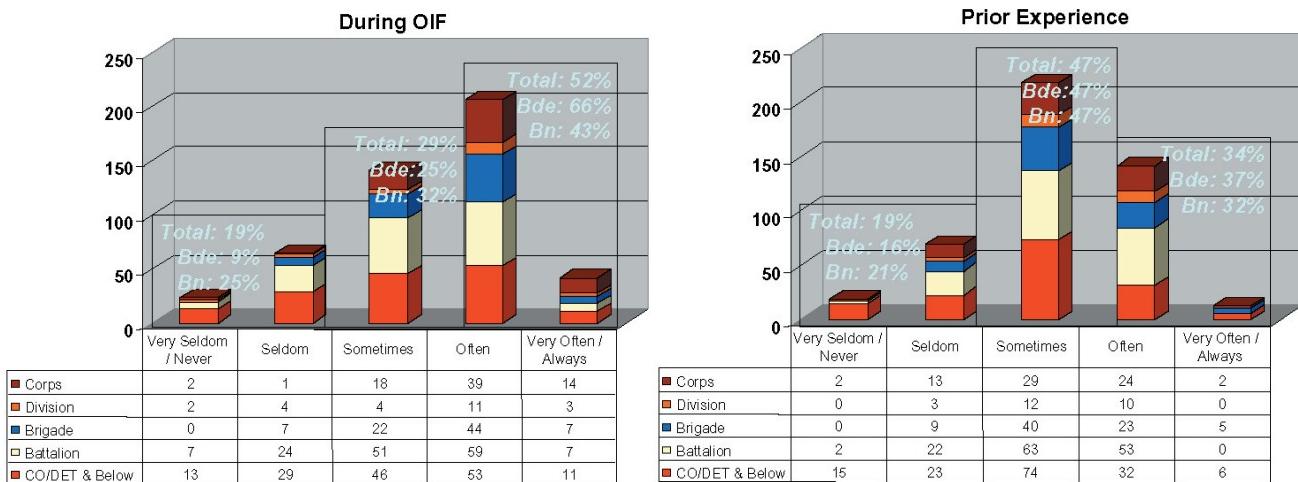
23. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how would you rate the impact of information systems on your ability to coordinate actions and/or weapon system capabilities?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		150	155	141	146	79	81	27	27	74	76
Mean		3.26	3.36	3.40	3.30	3.47	3.72	3.30	3.52	3.47	3.86
95% CI for Mean	Lower Bound	3.17	3.22	3.30	3.15	3.32	3.53	3.03	3.07	3.33	3.68
	Upper Bound	3.35	3.51	3.51	3.45	3.62	3.90	3.56	3.96	3.61	4.03
Median		3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	3.50	4.00
Variance		.328	.830	.371	.833	.432	.706	.447	1.259	.362	.605
Std. Deviation		.573	.911	.609	.913	.657	.840	.669	1.122	.602	.778

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		291	301	180	184
Mean		3.33	3.33	3.44	3.74
95% CI for Mean	Lower Bound	3.26	3.23	3.35	3.62
	Upper Bound	3.40	3.44	3.54	3.87
Median		3.00	3.00	3.00	4.00
Variance		.353	.829	.405	.749
Std. Deviation		.594	.911	.636	.865

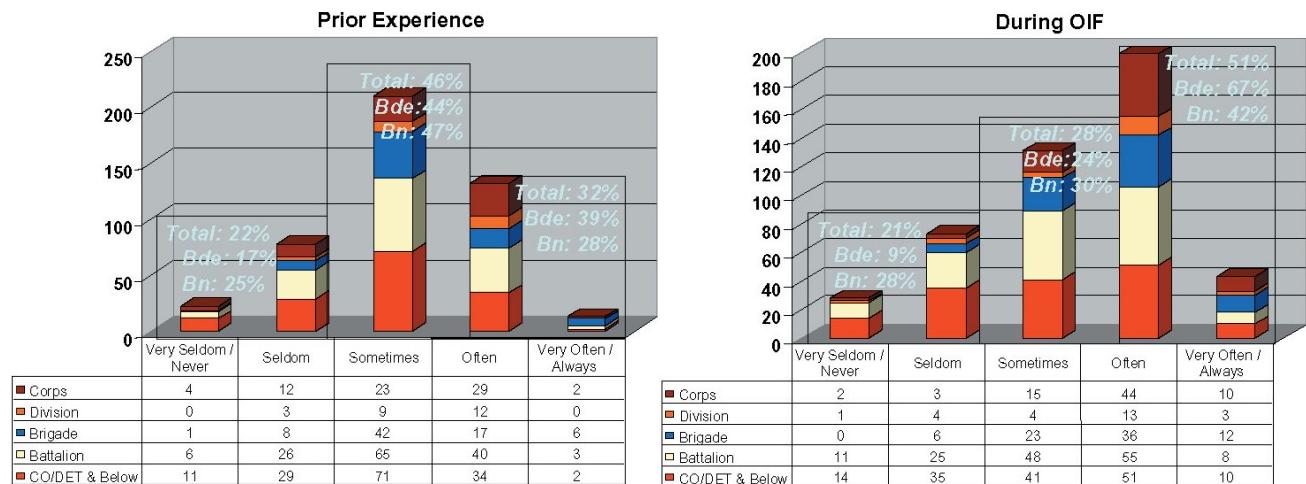
24. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the timeliness and accuracy of information allow you to coordinate actions/operations among other units/organizations/services?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		150	152	140	148	77	80	25	24	70	74
Mean		2.94	3.13	3.19	3.24	3.31	3.64	3.28	3.38	3.16	3.84
95% CI for Mean	Lower Bound	2.78	2.96	3.07	3.08	3.14	3.47	3.00	2.88	2.95	3.64
	Upper Bound	3.10	3.30	3.32	3.39	3.49	3.81	3.56	3.87	3.36	4.03
Median		3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	4.00
Variance		.929	1.161	.560	.889	.586	.588	.460	1.375	.743	.713
Std. Deviation		.964	1.078	.748	.943	.765	.767	.678	1.173	.862	.844

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		290	300	172	178
Mean		3.06	3.18	3.24	3.69
95% CI for Mean	Lower Bound	2.96	3.07	3.12	3.56
	Upper Bound	3.16	3.30	3.36	3.81
Median		3.00	3.00	3.00	4.00
Variance		.764	1.026	.630	.759
Std. Deviation		.874	1.013	.794	.871

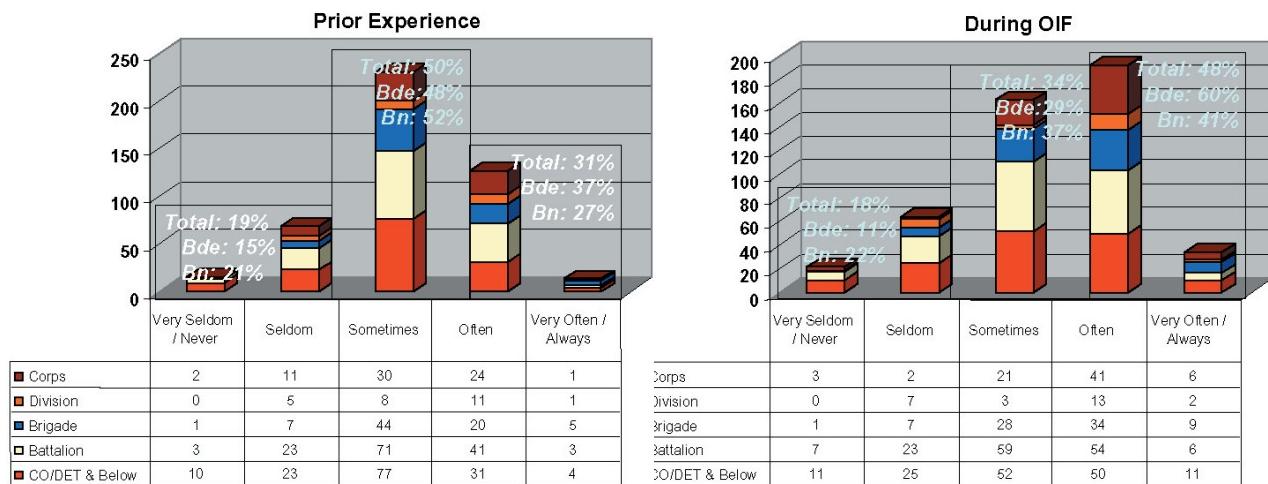
25. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did information systems provide situational awareness of key battlespace (BOS) elements in order to allow you to make timely decisions?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		147	151	140	147	74	77	24	25	70	74
Mean		2.91	3.05	3.06	3.16	3.26	3.70	3.38	3.52	3.19	3.77
95% CI for Mean	Lower Bound	2.77	2.88	2.91	3.00	3.07	3.51	3.07	3.09	2.96	3.58
	Upper Bound	3.06	3.23	3.20	3.33	3.44	3.89	3.68	3.95	3.41	3.96
Median		3.00	3.00	3.00	3.00	3.00	4.00	3.50	4.00	3.00	4.00
Variance		.780	1.211	.731	1.042	.659	.686	.505	1.093	.907	.700
Std. Deviation		.883	1.100	.855	1.021	.812	.828	.711	1.046	.952	.837

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		287	298	168	176
Mean		2.98	3.11	3.24	3.70
95% CI for Mean	Lower Bound	2.88	2.99	3.11	3.58
	Upper Bound	3.08	3.23	3.37	3.83
Median		3.00	3.00	3.00	4.00
Variance		.758	1.126	.736	.746
Std. Deviation		.871	1.061	.858	.864

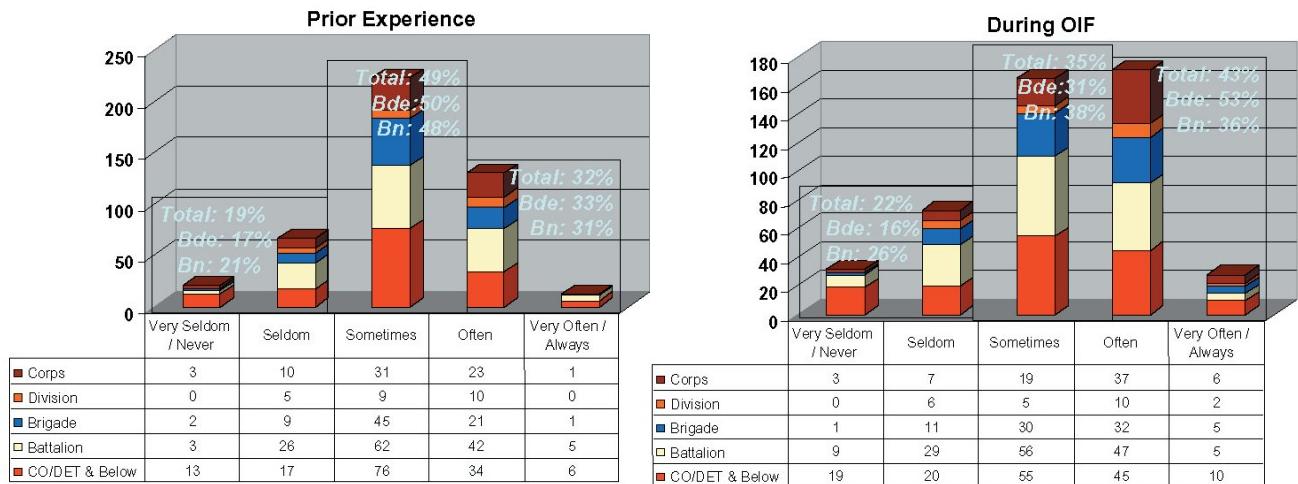
26. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the quantity, quality, timeliness and ability to share information allow you to take actions to mitigate/minimize risk? Battalion and below finding. Brigade and above finding



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		145	149	141	149	77	79	25	25	68	73
Mean		2.97	3.17	3.13	3.19	3.27	3.54	3.32	3.40	3.16	3.62
95% CI for Mean	Lower Bound	2.83	3.00	3.00	3.05	3.10	3.35	2.97	2.99	2.96	3.42
	Upper Bound	3.12	3.34	3.26	3.34	3.45	3.74	3.67	3.81	3.36	3.81
Median		3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	4.00
Variance		.763	1.073	.612	.833	.596	.738	.727	1.00	.675	.712
Std. Deviation		.874	1.036	.782	.913	.772	.859	.852	1.00	.822	.844

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		286	298	170	177
Mean		3.05	3.18	3.24	3.55
95% CI for Mean	Lower Bound	2.95	3.07	3.11	3.42
	Upper Bound	3.15	3.29	3.36	3.68
Median		3.00	3.00	3.00	4.00
Variance		.692	.950	.643	.760
Std. Deviation		.832	.975	.802	.872

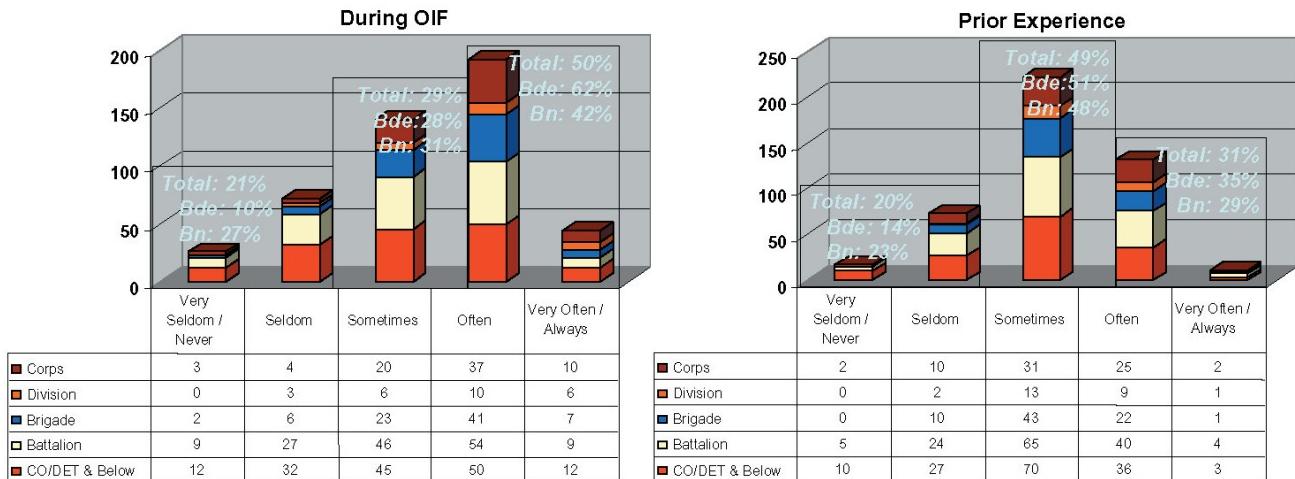
27. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the quantity, quality, timeliness and ability to share information allow you to be fully aware of the risk you were accepting? Battalion and below finding, Brigade and above finding



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		146	149	138	146	78	79	24	23	68	72
Mean		3.02	3.05	3.14	3.07	3.13	3.37	3.21	3.35	3.13	3.50
95% CI for Mean	Lower Bound	2.87	2.87	3.00	2.91	2.96	3.18	2.88	2.92	2.93	3.28
	Upper Bound	3.17	3.23	3.29	3.22	3.29	3.56	3.54	3.77	3.34	3.72
Median		3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00
Variance		.875	1.221	.709	.906	.529	.722	.607	.964	.714	.873
Std. Deviation		.936	1.105	.842	.952	.727	.850	.779	.982	.845	.934

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		284	295	170	174
Mean		3.08	3.06	3.14	3.42
95% CI for Mean	Lower Bound	2.98	2.94	3.02	3.28
	Upper Bound	3.19	3.18	3.26	3.55
Median		3.00	3.00	3.00	4.00
Variance		.796	1.061	.607	.811
Std. Deviation		.892	1.030	.779	.901

28. Comparing previous experiences (deployments, CTC rotations, etc.) to the major combat operations phase of OIF (20 MAR 03 to 1 MAY 03), how frequently did the quantity, quality, timeliness and ability to share information have a positive impact on operational tempo?



		CO/DET		Battalion		Brigade		Division		Corps	
		Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF	Prior	OIF
Responses		146	151	138	145	76	79	25	25	70	74
Mean		2.97	3.12	3.10	3.19	3.18	3.57	3.36	3.76	3.21	3.64
95% CI for Mean	Lower Bound	2.82	2.95	2.96	3.02	3.03	3.38	3.07	3.36	3.02	3.42
	Upper Bound	3.11	3.29	3.24	3.35	3.34	3.76	3.65	4.16	3.41	3.85
Median		3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	4.00
Variance		.792	1.172	.720	1.028	.446	.735	.490	.940	.693	.865
Std. Deviation		.890	1.083	.848	1.014	.668	.858	.700	.970	.832	.930

		Battalion & Below		Brigade & Above	
		Prior	OIF	Prior	OIF
Responses		284	296	171	178
Mean		3.03	3.15	3.22	3.62
95% CI for Mean	Lower Bound	2.93	3.03	3.11	3.49
	Upper Bound	3.13	3.27	3.33	3.76
Median		3.00	3.00	3.00	4.00
Variance		.759	1.099	.550	.812
Std. Deviation		.871	1.048	.742	.901